Ont

SESSIONAL PAPERS.

VOL. XXVIII.—PART IV.

SECOND SESSION EIGHTH LEGISLATURE

OF THE

37880
25/7/96.

PROVINCE OF ONTARIO.

SESSION 1896.

TORONTO:
PRINTED FOR LUD. K. CAMERON, QUEEN'S PRINTER,
BY WARWICK BROS. & RUTTER, 68 AND 70 FRONT STREET WEST.
1896.

LIST OF SESSIONAL PAPERS.

ARRANGED ALPHABETICALLY.

TITLE.	No.	REMARKS.
Accounts, Public	3	*Printed.*
Actions and References, pending	58	*Not printed.*
Agricultural College, Report	18	*Printed.*
Agriculture and Arts, Report	28	"
Archæological, Report (part of)	2	"
Asylums, Report	11	"
Bee-Keepers' Association, Report	22	*Printed.*
Births, Marriages and Deaths, Report	30	"
Blind Institute, Report	15	"
Bonds and Securities	59	*Not printed.*
Burlington Beach, correspondence	70	"
Cattle Breeders' Association	27	*Printed.*
Central Prison, Stock in Industrial Department	61	"
do agreement *re* binder twine	65	"
do cost of machinery *re* binder twine	67	"
do Massie charges	69	*Not printed.*
Childrens' Protection Act, Report	17	*Printed.*
Crown Lands, Report	5	"
Dairymen and Creameries, Report	24	*Printed.*
Deaf and Dumb Institute, Report	16	"
Division Courts, Report	7	"
Dominion Cattle Breeders' Association, Report	27	"
Doyle, Judge, Surrogate fees	42	*Not printed.*
Dysart, water lot	49	"
Education, Orders in Council in 1895	50	*Printed.*
do Ottawa Separate Schools	1	"
do Report	2	"
do affiliation, School of Pedagogy	64	"
do publication of Writing Course	71	"
do do Physical Science	72	"
do do Readers	73	"
do Normal Schools in London	52	*Not printed.*
do children passing leaving examinations	80	"

Title.	No.	Remarks.
Elections, return from Records of	41	*Printed.*
Elgin House of Industry Report	54	*Not printed.*
Elliott, Junior Judge, Surrogate fees	66	"
Entomological Society, Report	4	*Printed.*
Estimates	19	"
Factories, Report	29	*Printed.*
Farmers' Institutes, Report	25	"
Forestry, Report	40	"
Fruit, Experiment Stations	21	"
" Growers', Report	20	"
Game and Fish, Report	33	*Printed.*
Gaols, Common, Report	12	"
Hazelwood and Whalen, pulpwood agreement	74	*Not printed.*
Health, Report	35	*Printed.*
Hospitals, Report	14	"
Immigration, Report	36	*Printed*
Industries, Bureau, Report	6	"
Insurance, Report	10	"
Jones, Judge, commutation	43	*Not printed.*
Legal Offices, Report	31	*Printed.*
Library Report	78	"
License Commissioners, names, etc	47	*Not printed.*
Medical Council, prosecutions	48	*Not printed.*
Mosgrove, Judge, Surrogate fees	44	"
Municipal indebtedness	68	*Printed.*
Murdock, William	81	*Not printed.*
Normal Schools in London	52	*Not printed.*
Ottawa Separate Schools, Report	1	*Printed.*
Printing and Binding, amounts paid for	76	*Not printed.*
Poultry and Pet Stock, Report	23	*Printed.*
Public Accounts	3	"
Public Officers	63	*Not printed.*
Public Works, Report	9	*Printed.*
Pulpwood agreement	74	*Not printed.*
Queen Victoria Niagara Falls Park, Report	32	*Printed.*
Quiball, Police Magistrate	53	*Not printed.*
Refuge, Houses of	13	*Printed.*

Title.	No.	Remarks.
Registrar's fees	62	*Printed.*
Secretary and Registrar's Report	77	"
Sheep and Swine Breeders', Report	26	"
Smith, John W., Bailiff in Peel	56	*Not printed.*
Statutes, distribution	46	"
Stephenson, lands flooded in	60	"
Tavern and Shop Licenses, Report	8	*Printed.*
Titles, Report of Master of	55	"
Toronto General Trusts Company	57	*Not printed.*
Toronto University, Auditor's Report	37	*Printed.*
do Discipline Report	38	"
do Finance Report	39	"
do positions on staff	51	*Not printed.*
do applications for professorships	75	"
do affiliation with Oxford and Cambridge	79	*Printed.*
Upper Canada College, Report	45	*Not printed.*

LIST OF SESSIONAL PAPERS.

Arranged in Numerical Order with their Titles at full length; the dates when Ordered and when presented to the Legislature; the name of the Member who moved the same, and whether Ordered to be Printed or not.

CONTENTS OF PART I.

No. 1.. Report of the Commission relating to the Ottawa Separate Schools. Presented to the Legislature 12th February, 1896 (*Printed.*)

No. 2.. Report of the Minister of Education of the year 1895, with the Statistics of 1894. Presented to the Legislature 27th February, 1896. (*Printed.*)

No. 3.. Public Accounts of the Province for the year 1895. Presented to the Legislature 17th February, 1896. (*Printed.*)

No. 4.. Estimates for the Service of the Province until after Estimates of the year are finally passed. Presented to the Legislature 18th February, 1896. (*Not printed.*) Estimates for the year 1896. Presented to the Legislature 19th February, 1896. (*Printed.*) Estimates (supplementary) for the year 1896. Presented to the Legislature 1st April, 1896. (*Printed.*)

CONTENTS OF PART II.

No. 5.. Report of the Commissioner of Crown Lands for the year 1895. Presented to the Legislature 13th March. (*Printed.*)

No. 6.. Report of the Department of Immigration for the year 1895. Presented to the Legislature 20th March, 1896. (*Printed.*)

No. 7.. Report of the Inspector of Division Courts for the year 1895. Presented to the Legislature 20th March, 1896. (*Printed.*)

No. 8.. Report on the working of the Tavern and Shop Licenses Acts for the year 1895. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 9.. Report of the Commissioner of Public Works for the year 1895. Presented to the Legislature 20th February, 1896. (*Printed.*)

No. 10.. Report of the Inspector of Insurance and Registrar of Friendly Societies for the year 1895. Presented to the Legislature 12th February, 1896. (*Printed.*)

CONTENTS OF PART III.

No. 11.. Report upon the Lunatic and Idiot Asylums of the Province for the year ending 30th September, 1895. Presented to the Legislature 13th February, 1896. (*Printed.*)

No. 12.. Report upon the Common Goals, Prisons and Reformatories of the Province for the year ending 30th September, 1895. Presented to the Legislature 20th February, 1896. (*Printed.*)

No. 13.. Report upon the Houses of Refuge and Orphan and Magdalen Asylums of the Province for the year ending 30th September, 1895. Presented to the Legislature, 12th February, 1896. (*Printed.*)

No. 14.. Report upon the Hospitals of the Province for the year ending 30th September, 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 15.. Report upon the Institution for the Education of the Blind, Brantford, for the year ending 30th September, 1895. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 16.. Report upon the Institution for the Education of the Deaf and Dumb, Belleville, for the year ending 30th September, 1895. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 17.. Report of the Work under the Children's Protection Act for the year 1895. Presented to the Legislature 12th February, 1896. (*Printed.*)

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No. 18.. Report of the Ontario Agricultural College and Experimental Farm and Experimental Union for the year 1895. Presented to the Legislature 6th March, 1896. (*Printed.*)

No. 19.. Report of the Entomological Society of Ontario for the year 1895. Presented to the Legislature 23rd March, 1896. (*Printed.*)

No. 20.. Report of the Fruit Growers' Association of Ontario for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 21.. Report of the Fruit Experiment Stations of Ontario, for the year 1895. Presented to the Legislature 11th March 1896. (*Printed.*)

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No. 22.. Report of the Bee Keepers' Association of the Province for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 23.. Report of the Poultry and Pet Stock Associations of the Province for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 24.. Report of the Dairymens and Creameries' Associations of the Province for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 25.. Report of the Superintendent of Farmers' Institutes of the Province for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 26.. Report of the Sheep and Swine Breeders' Associations of the Province for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 27... Report of the Dominion Cattle Breeders' Association of the Province for the year 1895. Presented to the Legislature 31st March, 1896. (*Printed.*)

CONTENTS OF PART VI.

No. 28... Report of the Agriculture and Arts Association for the year 1895. Presented to the Legislature 31st March, 1896,

No. 29.. Report of the Inspectors of Factories for the Province for the year 1895. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 30... Report upon the Registration of Births, Marriages and Deaths in the Province for the year 1894. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 31.. Report of the Inspector of Legal Offices for the year 1895. Presented to the Legislature 20th March, 1896. (*Printed.*)

Ko. 32.. Report of the Commissioners for the Queen Victoria Niagara Falls Park for the year 1895. Presented to the Legislature 5th March, 1896. (*Printed.*)

No. 33.. Report of the Ontario Game and Fish Commission. Presented to the Legislature 28th February, 1896. (*Printed.*)

No. 34.. Report of the Bureau of Mines for the year 1895. Presented to the Legislature 31st March, 1896. (*Printed.*)

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No. 35.. Report of the Board of Health for the year 1895. Presented to the Legislature 19th March, 1896. (*Printed.*)

No. 36.. Report of the Bureau of Industries for the year 1895 Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 37.. Auditor's Report to the Board of Trustees on Capital and Income Account of the University of Toronto. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 38.. Report of the Commissioners on the Discipline and other matters in the University of Toronto. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 39.. Report of the Standing Committee on Finance of the University of Toronto. Presented to the Legislature 12th February, 1896. (*Printed.*)

No. 40.. Report of the Clerk in charge of the Forestry Branch, Crown Lands Department. Presented to the Legislature 31st March, 1896. (*Printed.*)

CONTENTS OF PART VIII.

No. 41.. Return from the Records of the several Elections to the Legislative Assembly in the Electoral Districts of West Algoma; the North Riding of the County of Brant, Kingston, South Wentworth and West Wellington, since the General Election of 1894, shewing: (1) The number of Votes polled for each Candidate in each Electoral District. (2) The majority whereby each successful Candidate was returned. (3) The total number of Votes polled in each District. (4) The total number of Votes remaining unpolled. (5) The number of names on the Voters' List in each District. (6) The number of Ballot Papers sent out, and how disposed of in each Polling Sub-Division. (7) The number of Tendered Ballots sent out. (8) The population of each District as shown by the last Census. Presented to the Legislature 13th February, 1896. (*Printed.*)

No. 42.. Copy of an Order in Council directing the payment out of the Surplus Surrogate fees of $115, to His Honour Judge Doyle. Presented to the Legislature, 12th February, 1896. (*Not printed.*)

No. 43.. Copy of an Order in Council increasing the commutation paid to His Honour Judge Jones. Presented to the Legislature 12th February, 1896. (*Not printed.*)

No. 44.. Copy of an Order in Council directing the payment out of the Surplus Surrogate fees of $500 to His Honour Judge Mosgrove Presented to the Legislature 12th February, 1896. (*Not printed.*)

No. 45.. Report of the Principal of Upper Canada College shewing the present attendance of pupils and also the statement of the Bursar for the year ending 30th June, 1895. Presented to the Legislature 12th February, 1896. (*Not printed.*)

No. 46.. Statement shewing distribution of Revised and Sessional Statutes for the year 1895. Presented to the Legislature 12th February, 1896. (*Not printed.*)

No. 47.. Return to an Order of the House of the Eleventh day of March, 1895, for a Return shewing the names, occupations and post office addresses of the License Commissioners of the Province for the years 1891-92-93 and 1894. Presented to the Legislature 12th February, 1896. Mr. *Ryerson.* (*Not printed.*)

No. 48.. Return to an Order of the House for the Third day of April, 1895, for a Return shewing the number of prosecutions instituted by agents or detectives of the Medical Council during the year 1894, for violations of the Medical Act, shewing the names of such prosecutors, the names of those prosecuted, the particular offence with which they were charged, and the fine or imprisonment imposed upon those persons convicted. Presented to the Legislature 12th February, 1896. Mr. *Caven.* (*Not printed.*)

No. 49.. Return to an Order of the House of the Third day of April, 1895, for a Return of copies of all applications for the purchase of the water lot in front of lot No. 15 in the 8th Concession of the Township of Dysart, in the County of Haliburton, and of all plans, petitions and correspondence relating to the issue of a patent of such water lot. Presented to the Legislature 12th February, 1896. Mr. *Carnegie.* (*Not printed.*)

No. 50.. Copies of Orders in Council relating to Educational matters approved of during the year 1895. Presented to the Legislature 13th February, 1896. (*Printed.*)

No. 51.. Return to an Order of the House of the Eleventh day of March, 1895. for a Return of copies of all letters received by the Minister of Education, and by other members of the Government, since the first day of January, 1891, recommending persons for positions on the staff of University College, and of the School of Practical Science. Presented to the Legislature 17th February, 1896. Mr. *Whitney.* (*Not printed.*)

No. 52.. Return to an Order of the House of the House of the Twenty-seventh day of March, 1895, for a Return of copies of all correspondence between any member of the Government and any person or persons referring to the establishment of a Normal School in the City of London, and a similar Return referring to the establishment of a Normal School in the Town of Woodstock. Presented to the Legislature 17th February, 1896. Mr. *Whitney.* (*Not printed.*)

No. 53.. Return to an Order of the House of the Third day of April, 1895, for a Return of copies of all correspondence between the Municipality of Sudbury and any member of the Government relating to W. A. Quiball, Police Magistrate of Sudbury. Presented to the Legislature 17th February, 1896. Mr. *Whitney.* (*Not printed.*)

No. 54.. Report of the Inspector of the Elgin House of Industry and Refuge, for the year 1895. Presented to the Legislature 18th February, 1896. (*Not printed.*)

No. 55.. Report of the Master of Titles for the year 1895. Presented to the Legislature 20th February, 1896. (*Printed.*)

No. 56.. Return to an Order of the House of the Tenth day of April, 1895, for a Return of copies of all correspondence, documents and writings, between any member of the Government, or any person or persons and the Government, in connection with the recent appointment of Mr. John W. Smith, of the Town of Brampton, as Bailiff of the First Division Court of the County of Peel, and of the dismissal of Mr. George Broddy. Presented to the Legislature, 21st February, 1896. Mr. *St. John.* (*Not printed.*)

No. 57.. Statement of the affairs of the Toronto General Trusts Company for the year 1895. Presented to the Legislature, 25th February, 1896. (*Not printed.*)

No. 58.. Return to an Order of the House of the Tenth day of April, 1895, for a Return, shewing all actions and references pending before Local Masters which have been pending for more than six months, with the dates, when the matters were brought into the Master's office, the present condition of such matters, and the reasons why same are not disposed of. Mr. *Middleton.* Presented to the Legislature, 27th February, 1896. (*Not printed.*)

No. 59.. Detailed Statement of all Bonds and Securities recorded in the Provincial Registrar's Office since the last return submitted to the Legislative Assembly upon the eighth day of March, A.D. 1895, made in accordance with the provisions of R.S.O., cap. 15. sec. 23. Presented to the Legislature, 28th February, 1896. (*Not printed.*)

No. 60.. Return to an Order of the House of the Twenty-sixth day of February, 1896, for a Return of copies of all correspondence, papers and documents, except that already brought down, between any member or officer of the Government, or any other person or persons, on the subject of claims for damages for the flooding of lands in the Township of Stevenson by the Government dam at the outlet of Mary Lake. Also, copies of all reports made by any Departmental officer, or any other person, to the Government, or any Department thereof, on the subject of such claims, or the damages occasioned by such works. Presented to the Legislature, 5th March, 1896. Mr. *Langford.* (*Not printed.*)

No. 61.. Return to an Order of the House of the Twenty-first day of February, 1896, for a Return shewing (1) the amount of stock on hand in each of the Industrial Departments of the Central Prison, at the stock taking on 30th September, 1894, and on 30th September, 1895. (2) The amount of material purchased for each of said departments during the year ending 30th September, 1895. (3) The amount of wages of all foremen and instructors employed in each of said shops during the year ending 30th September, 1895. (4) The number of days labour of prisoners detailed to each of said shops during said year, shewing the total number detailed whether employed or not. (5) The amount received, and amount still

owing for the produce of said industries sold during the year ending 30th September, 1895, and the amount received during the year ending 30th September, 1895, on account of sales previous to 30th September, 1894. Presented to the Legislature, 5th March, 1896. Mr. *Matheson.* (*Printed.*)

No. 62.. Statement of Returns forwarded to the office of the Provincial Secretary, of all fees and emoluments received by the Registrars of Deeds, for the Province of Ontario, for the year 1895, made in accordance with the provisions of 56 Victoria, cap. 21, sections 117, 120 and 121, and 57 Victoria, cap. 9, sections 6 and 7, with which are contrasted the gross amount of fees for the years 1893 and 1894. Presented to the Legislature, 6th March, 1896. (*Printed.*)

No. 63 . Copy of an Order of His Honour the Lieutenant-Governor in Council approved of the 15th day of August, 1895, approving of the Companies therein mentioned, as Security for Public Officers. Presented to the Legislature, 6th March, 1896. *Not printed.*

No. 64.. Copy of an Agreement, dated Third day of March, 1896, between the Minister of Education and the Board of Education of the City of Hamilton, affiliating the Ontario School of Pedagogy with the Hamilton Collegiate Institute. Presented to the Legislature 9th March, 1896. (*Printed.*)

No. 65.. Copy of an Agreement between the Inspector of Prisons and Public Charities and P. L. O'Connor, relative to the manufacture of binder twine at the Central Prison. Also, of Order in Council approved by His Honour the Lieutenant-Governor on the 1st day of October, 1895, authorizing the said Agreement. Presented to the Legislature 11th March, 1896. (*Printed.*)

No. 66.. Copy of an Order in Council, approved by His Honour the Lieutenant-Governor the 10th day of March, 1896, fixing the amount to be paid to His Honour Judge Elliott, Junior Judge of the County of Middlesex, out of the surplus Surrogate fees for the year 1895. Presented to the Legislature 13th March, 1896. (*Not printed.*)

No. 67.. Return to an Order of the House of the Sixth day of March, 1896, for a Return shewing the cost of the machinery, the cost of repairing and maintaining the same in order, and the cost of raw material used in connection with the manufacture of binder twine in the Central Prison, giving the aggregate amounts for each year from the beginning of the said industry to date; the amounts annually paid as commissions for the sale of the product; the cost of packages, freight, salaries of extra officials and all other expenditures incurred in connection with or occasioned by the said manufacture. The annual receipts from sales of binder twine during the said period, and the estimated value of the machinery, plant, material and stock on hand when the said industry was transferred to its present managers. Presented to the Legislature 13th March, 1896. Mr. *Haycock.* (*Printed.*)

No. 68.. Return to an Order of the House, of the Twenty fifth day of March, 1895, for a Return shewing the municipal indebtedness of the various municipalities of the Province on the 31st December, 1894, under the following heads :—

1. Roads and bridges.
2. Railway bonuses.
3. Aid to manufactures by way of bonus.
4. Municipal waterworks.
5. Waterworks belonging to companies.
6. Gas and electricity.
7. High and Public Schools.
8. Sewers.
9. Other purposes.
10. Also shewing any debenture debt for local improvements, not above included. Presented to the Legislature 23rd March, 1896. Mr. *Gibson (Huron.)* (*Printed.*)

No. 69.. Return to an Order of the House, of the Fourth day of March, 1896, for a Return of copies of all correspondence, documents and writings between any Member of the Government, or between any person or persons and the Government, in connection with the recent charges made by James Massie, late Warden of the Central Prison, against certain of the officials of the Prison. Also, for copies of the Commission, or other appointment, and the instructions given to the Commissioners who investigated the charges. Also, for a copy of all evidence taken before the Commissioners at the investigation, and of the report made thereon by the Commissioners. Presented to the Legislature 23rd March, 1896. Mr. *Marter.* (*Not printed.*)

No. 70.. Return to an Order of the House, of the Twenty-sixth day of February, 1896, for a Return of copies of all correspondence between any official of the Corporation of the City of Hamilton and the Department of Crown Lands, or any officer thereof, relating to any question affecting the rights of the City of Hamilton, or any person or persons, to certain portions of Burlington Beach ; also, for a copy of any instructions given to S. H. Jones, Esquire, P. L. S., as to defining the limits of any holding either leased to the City of Hamilton, or sold to any individual occupant ; also, for a copy of plan of survey made by Mr. Jones ; also, for a copy of the original, as well as the subsidiary lease, granted to the City of Hamilton by the Department of Crown Lands. Presented to the Legislature 24th March, 1896. Mr. *Dickenson.* (*Not printed.*)

No. 71... Copy of an Order in Council, approved by His Honour the Lieutenant-Governor, the 26th day of March, A.D. 1896, approving of the accompanying Agreement between the Canada Publishing Company (Limited), Publishers, of the City of Toronto, and Her Majesty the Queen, represented by the Minister of Education for the Province, on behalf of the Educational Department of Ontario, respecting the publication of "The Public School Writing Course, Vertical System," comprising seven separate books, for use in the Public Schools of Ontario. Presented to the Legislature 26th March, 1896. (*Printed.*)

No. 72.. Copy of an Order in Council, approved by His Honour the Lieutenant-Governor, the 26th day of March, A.D. 1896, approving of the accompanying Agreement between The Copp Clark Company (Limited), Publishers of the City of Toronto, and Her Majesty the Queen, represented by the Minister of Education for the Province, on behalf of the Education Department of Ontario, respecting the publication of "The High School Physical Science, Part 2." Presented to the Legislature 26th March, 1896. (*Printed.*)

No. 73.. Copy of an Order in Council, approved by His Honour the Lieutenant-Governor, the 26th day of March, A.D. 1896, approving of the accompanying Agreement between The Copp, Clark Company (Limited), The Canada Publishing Company (Limited) and The W. J. Gage Company (Limited), Publishers, of the City of Toronto, and Her Majesty the Queen, represented by the Minister of Education for the Province, on behalf of the Education Department of Ontario, respecting the publication of Public School Readers, consisting of:—The First Reader, Parts 1 and 2; the Second Reader; the Third Reader; the Fourth Reader and the High School Reader. Presented to the Legislature 26th March, 1896. (*Printed.*)

No. 74.. Return to an Order of the House of the Sixth day of March, 1896, for a Return of Copies of all agreements entered into between the Government and Hazelwood & Whalen, and the Government and G. P. Cleaner, James Whalen and others, respecting the cutting of pulp wood, or other timber, in the territory north of Lake Superior, together with copies of all correspondence in connection with the same. Presented to the Legislature 26th March, 1896. Mr. *Matheson.* (*Not printed.*)

No. 75.. Return to an Order of the House of the First day of April, 1895, for a Return of copies of all advertisements calling for applications for professorships, associate professorships and lectureships in the University of Toronto and University College since the University Federation Act went into force; also, copies of all applications for such advertised positions and of the testimonials in support thereof and in the possession of any Department of the Government; also, copies of all correspondence relating to such vacancies between the Government and any person holding official positions in connection with the management of either of the above institutions. Presented to the Legislature 30th March, 1896. Mr. *Howland.* (*Not printed.*)

No. 76.. Return to an Order of the House of the Eleventh day of March, 1896, for a Return shewing the amounts paid to Warwick Bros. & Rutter for printing and binding for the years 1894 and 1895, respectively, in terms of the agreement of 1893. Presented to the Legislature 30th March, 1896. Mr. *Meacham.* (*Not printed.*)

No. 77.. Report of the Secretary and Registrar of the Province for the year 1895. Presented to the Legislature 31st March, 1896. (*Printed.*)

No. 78..	Report of the Librarian upon the state of the Library. Presented to the Legislature 1st April, 1896. (*Printed.*)
No. 79..	Papers relating to the application of the Senate of the University of Toronto to the Universities of Oxford and Cambridge for the grant of special affiliation privileges. Presented to the Legislature 7th April, 1896. (*Printed.*)
No 80..	Return to an Order of the House of the Sixteenth day of March, 1896, for a Return shewing how many of the children in each City and County, who passed the leaving examination in 1895, are now attending the High Schools. Presented to the Legislature 7th April, 1896. Mr. *Meacham.* (*Not printed.*)
No. 81..	Return to an Order of the House of the Twenty-fifth day of March, 1896, for a Return of copies of all applications and correspondence in favour of and relating to the appointment of William Murdock as Farmer, or Assistant Farmer, at the London Asylum. Presented to the Legislature 7th April, 1896. Mr. *Whitney.* (*Not printed.*)

TWENTY-FIRST ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM.

SEVENTEENTH ANNUAL REPORT

OF THE

AGRICULTURAL AND EXPERIMENTAL UNION

1895.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.

TORONTO:
WARWICK BROS. & RUTTER, PRINTERS, ETC., 68 AND 70 FRONT ST. WEST.
1896.

TWENTY-FIRST ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL COLLEGE

AND EXPERIMENTAL FARM.

1895.

GUELPH, January 2nd, 1896.

To the Honorable JOHN DRYDEN,
Minister of Agriculture :

SIR,—I have the honor to transmit herewith the Twenty-first Annual Report of the Ontario Agricultural College and Experimental Farm.

In this report, the work of the year 1895 has been briefly reviewed under the following heads :

PART I. REPORT OF PRESIDENT.
PART II. REPORT OF ASSISTANT RESIDENT MASTER.
PART III. REPORT OF PROFESSOR OF GEOLOGY AND NATURAL HISTORY.
PART IV. REPORT OF PROFESSOR OF CHEMISTRY.
PART V. REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.
PART VI. REPORT OF PROFESSOR OF DAIRYING.
PART VII. REPORT OF AGRICULTURIST.
PART VIII. REPORT OF HORTICULTURIST.
PART IX. REPORT OF BACTERIOLOGIST.
PART X. REPORT OF EXPERIMENTALIST.
PART XI. REPORT OF FARM SUPERINTENDENT.
PART XII. REPORT OF MANAGER OF POULTRY DEPARTMENT.
PART XIII. REPORT OF APICULTURIST.
PART XIV. REPORT OF PHYSICIAN.
APPENDICES—I TO V INCLUSIVE.

I have the honor to be, Sir,
Your obedient Servant,

JAMES MILLS,
President

THE ONTARIO AGRICULTURAL COLLEGE

AND

EXPERIMENTAL FARM, GUELPH, ONT.

HON. JOHN DRYDEN, Toronto, Ont.,
Minister of Agriculture for Ontario.

James Mills, M.A., LL.D.	President.
J. H. Panton, M.A., F.G.S.	Professor of Natural History and Geology.
A. E. Shuttleworth, B.A. Sc	Professor of Chemistry.
J. H. Reed, V.S.	Professor of Veterinary Science.
H. H. Dean, B.S.A.	Professor of Dairy Husbandry.
Wm. Rennie	Farm Superintendent.
C. A. Zavitz, B.S.A.	Experimentalist.
G. E. Day, B.S.A.	Agriculturist.
H. L. Hutt, B.S.A.	Horticulturist.
F. C. Harrison, B.S.A.	Bacteriologist.
J. B. Reynolds, B.A.	Assistant Resident Master.
R. Harcourt, B.S.A.	Assistant Chemist.
L. G. Jarvis	Manager and Lecturer in Poultry Department.
R. F. Holtermann	Lecturer on Apiculture.
Captain Walter Clarke	Instructor in Drill and Gymnastics.
W. O. Stewart, M.D.	Physician.
G. A. Putnam	Stenographer.
A. McCallum	Bursar.

ADVISORY BOARD.

John I. Hobson, *Chairman*	Mosborough, County of Wellington.
John McMillan, M.P.	Constance, County of Huron.
Edward Jeffs	Bond Head, County of Simcoe.
J. S. Smith	Maple Lodge, County of Middlesex.
G. B. Boyce	Norham, County of Northumberland.
D. A. Dowling	Appleton, County of Carleton.
Wm. Donaldson	South Zorra, County of Oxford.
C. C. James, *Secretary*	Deputy Minister of Agriculture, Toronto.

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PART I.

REPORT OF THE PRESIDENT.

Our work during the past year has been pleasant, and in every way satisfactory. There has been perfect harmony among the officers of the institution, and every department has earnestly striven to do the best possible, both for the students in attendance and for the country at large. Within the last week or ten days, I have read twelve of the parts into which our report for 1895 is divided, and I have no hesitation in saying that the work done and instruction given, are on practical lines and in keeping with the great agricultural province which we have the honor to represent.

Certain Conditions Affecting the College.

Our College is unique among the institutions which provide education for the people of this province. It is the only educational institution in Ontario, excepting commercial schools and ladies' colleges, which has to rely wholly upon its merits. Students are legislated into our high schools, universities, theological halls, law school, medical schools, dental college, College of Pharmacy, and Veterinary College. If men and women were allowed to teach, preach, and practise law, medicine, dentistry, pharmacy, and the veterinary art, without passing a prescribed examination, the attendance of students at high schools, universities, and most of our technical schools and colleges, would be only a small fraction of what it is at the present time. Very few seek knowledge for its own sake.

If we could secure the enactment of a law which would compel people to pass a prescribed literary and professional examination before engaging in general agriculture, stock-raising, dairying, market gardening, or fruit growing, it would require a score of agricultural colleges in this province to accommodate the young men who would seek instruction in agriculture and the sciences related thereto. But, under present conditions, persons can engage in agricultural pursuits without any kind of preparation; and agricultural colleges, not having behind them the potent leverage of legal enactments, have to depend for their attendance solely upon the character of the education which they give, and upon the desire of young men here and there to obtain knowledge for its own sake, and for the possible advantage which it may be to them in their efforts to make a living. Under such circumstances, it is not surprising that the attendance of students at purely agricultural colleges is usually small.

Further, low prices for the products of the farm, and other things which make farming less profitable or less desirable as an occupation, have a two-fold tendency as regards education: First, to reduce the attendance of students at agricultural colleges; secondly, to drive young men from the farm to the high schools, and thence to the university or one of the technical colleges, with a view to gaining admission into some of the learned or other professions, where they each hope to make an easier and more respectable living than is possible on the farm.

Students in Attendance.

The number of students at the College in 1895 was 250—150 in the general course and 100 in the dairy school. Of those in the general course, exactly 80 per cent.—nearly all farmers' sons—were from the Province of Ontario. Six of the 100 dairy students were non-residents—four from Quebec and the eastern provinces, one from the United States, and one from Wales. See Nos. 3 and 4, Appendix I to this report.

County Students.

Each county in the province is allowed to send one student free of tuition, and the nomination is made by the county council. Of those on the roll in 1895, forty-five were so nominated, and as a consequence were exempted from the payment of tuition fees. The counties represented were the following:

Addington, Brant, Bruce, Carleton, Dundas, Elgin, Essex, Frontenac, Glengarry, Grey, Halton, Hastings, Huron, Lambton, Lanark, Leeds, Lennox, Middlesex, Muskoka, Northumberland, Ontario, Parry Sound, Peel, Perth, Prescott, Prince Edward, Renfrew, Russell, Simcoe, Victoria, Waterloo, Welland, Wellington, Wentworth.

Analysis of College Roll (See Appendix I.)

1. *General Course.*

(1) From Ontario.

Counties, etc.	Students.	Counties, etc.	Students.
Addington	1	Muskoka	3
Brant	4	Northumberland	2
Bruce	1	Ontario	2
Carleton	2	Oxford	3
Dundas	7	Parry Sound	4
Durham	2	Peel	1
Elgin	1	Perth	6
Essex	3	Peterboro'	2
Frontenac	4	Prescott	3
Glengarry	5	Prince Edward	1
Grey	4	Renfrew	1
Haldimand	1	Russell	3
Halton	3	Simcoe	8
Hastings	1	Victoria	2
Huron	4	Waterloo	2
Kent	1	Welland	1
Lambton	1	Wellington	6
Lanark	3	Wentworth	1
Leeds	1	York	3
Lennox	2	Toronto	10
Lincoln	2		——
Middlesex	3		120

(2) From Other Provinces of the Dominion.

Provinces, etc.	Students.	Provinces, etc.	Students.
British Columbia	3	Prince Edward Island	2
Manitoba	1	Quebec	3
Nova Scotia	3		—
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ONTARIO AGRICULTURAL COLLEGE, GUELPH.

GENERAL VIEW OF COLLEGE AND FARM BUILDINGS.

(3) From Other Countries.

Countries.	Students.	Countries.	Students.
Bermuda	3	Ireland	1
England	7	Scotland	3
France	1	United States	2
India	1		18

Total in General Course—150.

2. *Dairy Course.*

Counties, etc.	Students.	Counties, etc.	Students.
Brant	2	Ontario	3
Bruce	4	Oxford	3
Carleton	4	Peel	1
Dundas	4	Perth	4
Elgin	2	Peterboro'	5
Glengarry	2	Russell	2
Grey	2	Simcoe	1
Grenville	1	Stormont	3
Haldimand	1	Victoria	1
Halton	3	Waterloo	2
Huron	5	Wellington	8
Kent	1	York	10
Lambton	3		
Lanark	2	British Columbia	1
Leeds	3	New Brunswick	1
Lennox	3	Nova Scotia	1
Middlesex	3	Ohio	1
Northumberland	3	Quebec	1
Norfolk	3	Wales	1

Total of dairy students—100.

This analysis shows that students in both courses came from all parts of the province. Forty-one counties and districts were represented in the general course, and thirty-one in the dairy course. For the general course, the county of Simcoe sent eight, Dundas seven, Perth six, Wellington six, Glengarry five, and other counties smaller numbers. In the dairy course, the largest number was from York, which sent ten. There were eight from Wellington, five from Huron, five from Peterborough, and four each from Bruce, Carleton, Dundas, and Perth.

Age of Students in General Course.

7	16 years of age.	6	24 years of age.
19	17 "	8	25 "
25	18 "	3	26 "
24	19 "	3	27 "
19	20 "	2	29 "
16	21 "	1	30 "
9	22 "	1	32 "
7	23 "		

Average age of students in general course—20 years.

Average age of students in dairy course—23 years.

Religious Denominations.

1. *Students in General Course.*

Presbyterians	55	Roman Catholics	3
Methodists	51	Friends	2
Episcopalians	23	Protestant	1
Baptists	11		
Congregationalists	4	Total	150

2. *Students in Dairy Course.*

Methodists	35	Congregationalists	2
Presbyterians	34	Christian Church	2
Baptists	11	United Brethren	1
Episcopalians	11		
Catholics	4	Total	100

A Preparatory Department.

For some years we refused admission to all who were unable to pass our matriculation examination, which is the same as that fixed by law for entrance into the high schools of the province; and, considering the number and character of our public schools, we could see no reason why we should not do so. This course was simple and in many respects satisfactory; but it resulted in the admission of a large proportion of city boys and others who readily passed the required examination, but did little or nothing thereafter. This injured our reputation among the farmers and with other people who were being constantly influenced by reports and stories about the character and conduct of our students. Hence we made the terms of admission somewhat easier. We admitted a number of farmers' sons who, from one cause or another, had grown up without being well grounded in the elementary branches of an English education. Some of these were very crude; but they knew the value of time—they worked hard, made rapid progress, and did much towards changing the entire character of our college life, so that, at the present time, we have as orderly and well-behaved a lot of students as can be found in any part of the world. The change was very gratifying, but our troubles were not at an end, because we found great difficulty in teaching together students of such varied attainments—university undergraduates, second-class teachers, third-class teachers, some who had just passed the high school entrance examination, and others who had not been at school for five or six years. This difficulty continued from year to year, till in July last we decided to form a preparatory department and ask for an additional master to teach English grammar, composition, arithmetic, drawing, and one or two other branches. With such additional help, we can make a more satisfactory classification of our students, and shall be able to teach all grades to much better advantage.

Fees.

Ontario students not nominated by county councils pay a tuition fee of $20 a year, and non-residents (from other provinces, Great Britain, and elsewhere) pay a fee of $100 the first year, and $50 the second year. If a non-resident student has had a year's experience in practical work on a farm, his tuition fee for the first year is $50.

New Buildings.

The equipment of the institution has been improved during the year by the addition of three new buildings—a large and commodious experimental building, a special piggery for experimental feeding and a dwelling house for the manager of the poultry department.

Fowl kept in close quarters have to be carefully looked after, and while our poultry manager lived in the city (a mile and a half from the College), he could not give his department the early and late attention which it required. Hence we had to provide a house for him on the College grounds—not a large or expensive residence, but a handsome red brick cottage, sufficiently large for an ordinary family, and located within about fifty yards of house No. 1 in the Poultry Department.

For some time our Agriculturist has been anxious to do something more systematic and elaborate in the feeding of stock than has yet been done in this province; but hitherto we have not had our buildings arranged for thoroughly scientific work on this line. Now, however, I think I am warranted in saying that we are fairly well equipped for experimental work in the feeding of cattle, sheep and pigs. We have erected a special piggery for the purpose (see Part VIII of this report), and have overhauled an old barn, changing it into a root-house, feed-room, cattle stable, and sheep-pen, all specially arranged for experimental feeding.

These additions to the buildings of the institution place us in a position to do better work than we have hitherto done in the poultry and live stock departments; but the chief addition to our equipment in 1895 was our new experimental building. This is a large two-storey white brick structure, erected on the College campus, a short distance below the gymnasium. The main portion of it is forty-five by seventy feet, and a wing attached thereto is thirty-eight by fifty-two. In this building there are sixteen rooms—an office, an agricultural museum, three large work-rooms, a tool room, a dark room for photography, and six or seven basement rooms, all for the use of the experimental department; also an office and an agricultural laboratory for the Department of Agriculture; an office, a private laboratory, a work room, and a students' laboratory for the Department of Bacteriology; a class-room for practical instruction in live stock; and a lecture-room for the use of the Agriculturist, the Bacteriologist, and the Professor of Veterinary Science.

Alterations in Buildings—Physical Class-room.

Several alterations in the main Collge building were made in 1895, with a view to securing an additional class-room and providing accommodation for the Superintendent of farmers' institutes. By these changes we have secured suitable quarters for the important department of institute work, and have got a large and nicely furnished class-room for lectures and practical work in physics, and instruction in mechanics, hydrostatics, electricity, etc. With J. B. Reynolds, B.A., a first-class physicist, in charge of this department, we look for excellent results—for work which will be of much practical value to our students in after life. (See Mr. Reynolds's report in Part II of this volume.)

Geology and Biology.

Our course in geology is not an extensive one, but it is sufficiently broad for practical purposes. It embraces a concise but comprehensive statement of the outlines of general geology and a full discussion of the geology of the Dominion of Canada, with a detailed account of soils and soil formation, all illustrated by a complete and systematically arranged geological cabinet.

A reference to our circular for 1895-96 will show that our work in biology is much more extensive, and requires a much wider course of reading than the outline prescribed in the early days of the institution. It now includes the whole field of botany—structural, physiological, systematic, and economic—vegetable histology and plant pathology, a full course of lectures on general geology, and a considerable amount of laboratory practice in both zoology and botany.

Prof. Panton has had charge of the work of this department as usual, excepting the vegetable histology and plant pathology, which were taken by Mr. F. C. Harrison, our bacteriologist. (See Prof. Panton's report in Part III of this volume).

Important Chemical Investigations for the Dairy Department.

In Part IV of this volume will be found a very valuable report of work done in our chemical laboratory during the year 1895. In this report, Professor Shuttleworth gives in detail the results of an elaborate series of experiments in the analysis of milk, whey, and cheese, carried on by the help of four assistant chemists throughout the season, from April to December : (1) to determine the ratio of casein to fat in poor, medium, and rich milk—to ascertain whether it varies as the fat varies or not; (2) to determine whether the fat in milk is the exact measure of its cheese-producing power, that is, whether the cheese made from poor, medium, or rich milk, is exactly in proportion to the fat contained in the milk.

Both these lines of investigation were pursued with great care and accuracy throughout the cheese-making season, for the purpose of assisting Professor Dean and those associated with him in the Dairy Department in their efforts to find a just and satisfactory method of paying patrons for the milk supplied to cheese factories.

Veterinary Science.

Dr. Hugo Reed, our Veterinary Surgeon, looks after the live stock of the institution from year to year, and lectures from four to five hours a week on veterinary anatomy, pathology, materia medica, and obstetrics, giving a broad, accurate, and thoroughly practical knowledge of veterinary science and practice. Dr. Reed's stable lectures and his demonstrations in "practical horse" are specially interesting and profitable to all classes of students. (See Dr. Reed's report in Part V of this volume.)

Important Experimental Work in the Dairy Department.

Since the invention of the Babcock milk-tester, it has generally been admitted by well informed men that the practice of paying for milk at cheese factories by measure or weight is unjust. It gives the man with rich milk much less than his due ; and by experiments made at this institution and elsewhere, it has recently been proved beyond question, that this method of payment is so utterly unfair that it should be at once abandoned by all factories which wish to deal justly with their patrons.

Almost immediately after the introduction of the tester, it was argued by prominent dairymen, and especially by Dr. Van Slyke, of the New York Experiment Station, Geneva, N. Y., that the percentage of fat should be made the basis of payment for milk at factories—that the sum paid for each 100 pounds of milk should be exactly in proportion to the amount of fat contained in it. Many maintain that this method does justice to all parties. Certainly no one can deny that it is much fairer than the quantity method ; and it has the merit of encouraging the production of good milk.

For a short time, it seemed that the fat basis of payment would be generally adopted ; but our Prof. Dean, with the help of our chemist, made some experiments in 1894 which led him to the conclusion that this method gave the man with rich milk something more than his equitable share ; and he then took the position that the percentage of fat plus some number, say one per cent., would be a fairer basis of payment than the fat alone. He published a bulletin to that effect, and it made a great commotion among dairymen. It was said that Prof. Dean had been hasty and injudicious in making statements which would seem in any way to discredit the fat method—that he had not sufficient data for his conclusions, etc., etc. The result was that we at once employed a first-class cheese-maker and four additional chemists, to assist our professors in a thorough investigation of the question. They worked continuously for nine and a half months with milk from our own herd, from a number of cows in the neighborhood of Guelph, and from two cheese factories in different parts of this county. Cheese were made from all kinds of milk and according to the best methods known in this country ; the milk, whey, and cheese were analyzed by the chemist and his assistants ; the cheese were judged from time by recognized experts ; and the results obtained from

the year's work, unquestionably justify the conclusions announced in 1894, viz., that some number representing the casein of milk should be added to the percentage of fat to get a strictly equitable basis of payment.

Prof. Shuttleworth has suggested an addend which varies somewhat according to the richness of the milk; but Prof. Dean favors the addition of two per cent. (a little less than the average percentage of casein in milk) to all percentages of fat. This, he maintains, is simple, and gives results which are practically correct and fair to all parties.

We have, then, at the present time, three methods of paying for milk supplied to cheese factories in this province:

(1) *The quantity method*, which is utterly unfair and should be abandoned.

(2) *The fat method*, which is very much fairer than the quantity method but is regarded by many as a little too much in favor of the rich milk, that is, milk with about four per cent. of fat and upwards.

(3) *The fat and casein method*, which, so far as we can judge from our experiments, is the most equitable method.

For a full and interesting account of this and other experimental work in the Dairy Department, see Prof. Dean's report in Part VI of this volume.

Dairy School.

The third session of our Dairy School opened on the 15th January last and continued till the 15th March for special dairy students, and half a month longer for students in the regular College course. There were 100 special dairy students in attendance, and the work of instruction in milk-testing, butter-making, cheese-making, and the running of cream separators, was in every way satisfactory. A very considerable proportion of those in attendance succeeded in passing the prescribed examinations on the subjects in the course, and received non-professional certificates. After a year's successful and approved management of a factory, these non-professionals will receive professional certificates.

Dairy Circular.

The following circular was issued in the month of August for the session to commence on the 14th January, 1896:

The Dairy School in connection with the Agricultural College, Guelph, will re-open January 14th, 1896, and remain in session to the 14th March—a period of two months.

Our buildings and equipment are complete, and we are now in a position to offer students a very broad and thorough course of theoretical and practical instruction in dairying. In addition to the ordinary appliances, we have in the dairy stable, close to the school, a herd of thirty cows of different breeds, for observation and instruction in the methods of feeding and caring for dairy stock, and a cream separator run by tread power in a room attached to the dairy barn.

The course of practical instruction consists of two branches of the dairy business, viz.: Factory Dairying and Home Dairying.

Factory Course.

In this course, students, under competent instructors, make cheese and butter on a large scale, learn how to run separators, and are given full and repeated instruction in the use of the Babcock tester and the lactometer, together with directions as to the simplest and fairest method of paying patrons for their milk in factories where the Babcock tester is used.

There are five large cream separators in this department—the Danish Weston, the Alexandra, the Alpha de Laval, the United States, and the Sharples' Imperial Russian. Full and repeated instruction with practice in the running and general management of these machines is given daily throughout the session. In the milk-testing room there are seven or eight of the best makes of the Babcock tester, of different capacities, some run by hand and others by steam—all for the use of the students in attendance from year to year; and in the butter room there is constant practice throughout the session in churning, and in the working, printing, and packing of butter according to the most approved methods.

Discussions on practical dairy topics, especially on the difficulties which arise in making cheese and butter, are carried on in the cheese room for an hour every afternoon. These discussions have been of much value to students; and they will be continued in the future as in the past. From time to time during the session, this hour is devoted to the judging of cheese and butter by experts brought to the school for that purpose. The scoring of the judges is compared with that of the students and reasons given for the conclusions reached in each case. In this way, students get a clear conception of the difference between poor, medium, and first-class goods.

Cheese and butter factories should encourage their makers to devote a couple of months in the winter to this course. It is not intended to take the place of practical experience in a factory, but to supplement it. It is of much practical value to those who take it and will undoubtedly result in material advantage to the factories in which they are employed.

Home Dairy Course.

This course is intended especially for farmers' sons and daughters who wish to learn something about running cream separators, using the Babcock tester, and making butter on a farm. The department is furnished with hand separators, butter workers, printers, etc.; and full instruction is given by a competent butter-maker in every detail regarding home dairy appliances, the handling of milk and cream, and the making of butter. Special instruction in cheese-making is also given when required.

Home dairy students are admitted to all lectures and discussions, including practical drill by the Professor of Dairying on the points and peculiarities of dairy cows, in a live-stock class-room provided for the purpose.

We can accommodate from fifteen to twenty in this course, and we hope to see the full number in attendance throughout the session. Applicants may enter on or after the 14th January and remain as long as they wish—two weeks, the entire session of two months, or longer. Those who decide to take the course, should write at once, stating when they desire to enter and how long they can remain.

Instructors.

1. Cheese-making. T. B. Millar, London, Ont., Instructor and Inspector for Western Dairymen's Association; Assistant, R. W. Stratton, Guelph, Ont., Experimental Cheese-maker at the Ontario Agricultural College.

2. *Milk-testing.* J. W. Mitchell, B.A., Lansdowne, Ont.

3. Cream-Separators. Mark Sprague, Ameliasburg, Ont., Instructor for Creameries' Association.

4. Butter-making. T. C. Rogers, Experimental butter-maker; Assistant, J. H. Findlay, Barrie, Ont.

5. Home Dairy. Jas. Stonehouse, Port Perry, Ont.

Lectures.

A course of fifty lectures will be given as follows:

Professor of Dairying. Twenty-four lectures on milk, butter, and cheese; milk-testing, butter-making, and cheese-making; the marketing of dairy products; selection, breeding, and feeding of dairy-stock, etc., etc.

Agriculturist. Three lectures on general Agriculture in relation to dairying.

Professor of Veterinary Science. Three lectures on the diseases and treatment of dairy-stock.

Professor of Biology. Four lectures; two on geology and two on botany.

Professor of Chemistry. Four lectures on the nomenclature and general principles of chemistry and its relation to dairying.

Bacteriologist. Five lectures on lacteal bacteriology.

Mathematical Master. Seven lectures on mathematics and book-keeping, explaining fully the decimal system.

Lectures will begin at 8.30 a.m., and continue for one hour, after which practical work will commence.

Certificates.

Certificates of standing—for cheese-making, or butter-making, or both—will be given to those who pass all prescribed written and practical examinations, some during the course and a more difficult one at the close. The standard for passing is forty per cent.; for second-class honors, sixty per cent.; and for first-class honors, seventy-five per cent. To obtain this certificate, students must attend at least *seven weeks* during the course and take the regular work from day to day.

To anyone who holds a general certificate of standing, a special dairy certificate of proficiency in butter-making, cheese-making, or both, will be granted when he has proved his ability to manage a creamery or cheese factory—

(1) By at least two years' experience as manager, one of which must be subsequent to his College course.

(2) By sending monthly factory reports during at least one season to our Professor of Dairying.

(3) By passing a satisfactory inspection as to cleanliness, tidiness, and quality of goods made by him during the season.

Terms of Admission, Cost, Etc.

No Entrance Examination Required.

Tuition. Free to residents of the Province of Ontario; to non-residents, $5 for the course.

Incidentals. A payment of $3 in advance for incidental expenses will be required of all students in the regular course. Also a deposit of $2 to cover possible breakage. This sum of $2, if not required for breakage, will be refunded when the student leaves.

Board and Lodging in Guelph (a mile and a half from the College), or close to the College grounds, $3 per week.

Working Clothes. Each student must provide two special suits of clothes to be worn in the dairy—white and blue gingham dress, with white cap and white apron for ladies; and white linen or cotton suit, with white cap and white apron for men. These suits, including cap and apron, can be bought in Guelph for $1.50 to $2 each; and we may add that they must be kept clean throughout the session.

Home Dairy Course. A charge of $1 for incidental expenses, and a deposit of $1 to cover breakage. The latter, if not required, will be refunded when the student leaves. One suit of working clothes will be sufficient for this course. Board and lodging the same as for other students.

Prohibitions.

Card-playing, smoking, tobacco chewing, spitting, and noisy or boisterous conduct in any of the dairy buildings are strictly prohibited.

Ladies Invited.

We have made special provision for ladies who wish to take either the factory or the home dairy course. Separate apartments have been fitted up and furnished for their comfort and convenience. Six ladies were in attendance last session; and we hope to have a larger number in 1896.

Applications for admission should be addressed to the President of the College.

Candidates whose applications are accepted will be expected here on the *first day* of the course; and all students will be required to attend the lectures and practical work regularly and punctually while they remain at the school.

For further information apply to H. H. Dean, B.S.A., Professor of Dairying.

James Mills,
President.

Ontario Agricultural College,
Guelph, August, 1895.

Travelling Dairy.

Our Travelling Dairy was at work from the 9th May to the 21st November. It was in charge of F. J. Sleightholm, B.S.A., with J. Hume as butter-maker. The territory covered during the season embraces the following ridings and counties: North Ontario, Victoria, Peterborough, Russell, Prescott, and Simcoe. As a rule, the meetings were well attended and close attention was given both to Mr. Sleightholm's lectures and to the practical work done by Mr. Hume. The unanimous verdict is that the Travelling Dairy is doing a work of much value to the farmers of Ontario. Wherever it has gone, great interest in dairying has been created and the quality of home-made butter has been very much improved. In several instances, cheese factories have been started in consequence of the work done and interest created by the Travelling Dairy.

Farm and Live Stock.

Work in the Agricultural Department of the institution has gone on as usual. Our Agriculturist, G. E. Day, B.S.A., has taken charge of the pedigrees and registration of stock, (cattle, sheep, and swine), has attended to a large share of the correspondence of the department, has done the class-room work in agriculture and live stock, and has given some instruction in practical operations, such as hand-sowing, mowing, the handling of sheep, etc.—all to the satisfaction of the students and others concerned. See Mr. Day's report in Part VII of this volume.

Our farm is now in good shape, thoroughly cultivated and well managed; and it is bare justice to Mr. Wm. Rennie, our Farm Superintendent, to say that the College farm is cleaner, better tilled, and much more productive than it has been at any time within the last seventeen years. We can now refer, without the least misgiving, to our own farm practice in illustration of the lectures given in our class-rooms. Every part of Mr. Rennie's management is characterized by economy and efficiency, and it is to me personally a constant source of gratification. For an account of Mr. Rennie's experience in fencing, cattle feeding, etc., see his report in Part XI of this volume.

Co-operative Experiments.

A system of co-operative experimental work has been carried on for ten years in succession throughout Ontario. The following table gives the number of ex-students of the College and other farmers in Ontario engaged in this work, for seven of the years since these co-operative experiments were begun :

In 1886 there were 12 co-operative experimenters.
" 1888 " 90 " "
" 1891 " 203 " "
" 1892 " 754 " "
" 1893 " 1,204 " "
" 1894 " 1,440 " "
" 1895 " 1,699 " "

Within the last five years, our Experimental Department has distributed upwards of 32,000 packages of choice seeds to ex-students and other Ontario farmers.

For the results of the co-operative experiments in 1895, see the report of the Experimental Union in Appendix VI to this report.

The following table indicates the character and extent of the work done throughout the province :

Numbers of experiments.	Names of Experiments.	Number of plots required for each experiment in 1895.	Class of experiments.	Number of plots used for these tests by farmers over Ontario.				
				1891.	1892.	1893.	1894.	1895.
1	Testing nitrate of soda, superphosphate, muriate of potash, mixture, and no manure, with oats..	5	Fertilizers.	70	165	322	318	337
2	Testing nitrate of soda, and no manure, with rape	2						
3	Ascertaining the relative value of four varieties of millet	4						
4	Growing lucerne as a crop for fodder	1	Fodder crops.	196	470	894	897	1,289
5	Growing crimson clover as a crop for hay.....	1						
6	Testing six leading varieties of corn.....	6						
7	Testing five leading varieties of turnips	5	Root crops.	350	705	1,230	1,310	1,480
8	Testing five leading varieties of mangels	5						
9	Testing five leading varieties of carrots	5						
10	Testing five leading varieties of spring wheat....	5	Grain crops.	2,026	4,348	4,735	4,794	5,629
11	Testing five leading varieties of barley.....	5						
12	Testing six leading varieties of oats.....	6						
13	Testing four leading varieties of peas	4						
15	Testing five leading varieties of winter wheat	5						
16	Testing six leading varieties of potatoes.....	6	Potatoes.				402	444
		65		2,642	5,688	7,181	7,721	9,179

Field Experiments at the College.

Our Experimental Department has made rapid and substantial progress within the past ten years. Our field experiments are now conducted on a more extensive scale than at any other institution of which we have any knowledge ; and I do not hesitate to refer to the report of Mr. Zavitz, our Experimentalist, in Part X of this volume, as one of the most valuable reports published in this country. Since 1888, the number of plats devoted to field experiments has increased nearly forty-fold. The following figures show the numbers for the last eight years :

In 1886, we had 56 plots devoted to experimental work.
" 1889, " 464 " " "
" 1890, " 625 " " "
" 1891, " 1,045 " " "
" 1892, " 1,523 " " "
" 1893, " 1,612 " " "
" 1894, " 1,705 " " "
" 1895, " 2,005 " " "

In 1895, our grain experiments occupied 654 plots; potatoes, 364; roots, 376; fodder crops, 509; and miscellaneous crops, 32. Seventy additional plots were used for experiments made in connection with the Ontario Agricultural and Experimental Union. Elaborate series of tests were made with all kinds of farm crops—variety tests, tests in the selection of seed, tests in the method of preparing potatoes for planting, etc.; also tests with various crops, by sowing at different dates, planting at different depths, cultivating in different ways, and harvesting at different stages of maturity. Likewise a number of experiments to test special fertilizers.

Horticulture.

Our Horticultural Department embraces the six greenhouses belonging to the institution; a large garden (nearly six acres), devoted to the growing of vegetables for the College; two or three acres of small fruits—gooseberries, strawberries, currants, and raspberries; a small vinery; our apple orchards; the College lawn, or campus (between thirty and forty acres), with the walks and driveways therein; the College arboretum; and a number of forest-tree plantations scattered over the farm.

The mere enumeration of these branches, or subdivisions, will indicate very clearly to men of experience that there is a large amount of work in our Horticultural Department. Mr. H. L. Hutt, our Horticulturist, lectures on horticulture, gives more or less practical instruction in the gardens and greenhouses, and takes general oversight of the work He is ably assisted in the outside work by his foreman, Mr. William Squirrell, and in the greenhouses by Mr. Arthur James, Florist and Assistant Gardener.

So far, our efforts at fruit-growing have not been very satisfactory, for two reasons: (1) The fact that our apple orchard was planted in the wrong place (a very unsuitable place) twelve or thirteen years ago, and had to be taken up and a new one planted in 1890; (2) and chiefly because of unfavorable climatic conditions—conditions much more trying than in localities a hundred miles farther north, and not so good for grapes, etc., as Ottawa and other places where the snowfall is much heavier.

Fruit Experiment Stations.

Very valuable work is now being done in our Fruit Experiment Stations throughout the province. We have stations at the following places: 1. South-west station, in the county of Essex, to test varieties of peaches and strawberries, especially peaches; 2. Niagara station, near St. Catharines, for tender fruits; 3. Wentworth station, at Winona, with grapes as a specialty; 4. Halton station, near Oakville, for small fruits; 5. Huron station at Walkerton, for apples and other fruits suitable to that locality; 6. Georgian Bay station, near Thornbury, withplums as a specialty; 7. Simcoe station, at Craighurst, for hardy apples; 8. Eastern Central station, Whitby, for pears and apples; 9. Prince Edward Station, for apples; and 10. St. Lawrence station, near Maitland, Grenville county, for apples and other fruits suited to that locality. In addition to these ten stations, there are two sub-stations, one in South Simcoe, for gooseberries, and another at Burlington, for strawberries.

Our Horticulturist devotes a considerable amount of time to these stations. He visits them and reports uppn their work every year, and assists in the selection of varieties to be tested in the different localities. Before long, the results obtained from these stations will be of great value to the farmers of Ontario. (See Mr. Hutt's report in Part VIII of this volume.)

Birds and Bees.

Two new departments have been in operation during the past year, viz., the bird and bee departments, or poultry and apiculture.

Mr. L. G. Jarvis has had charge of our poultry, and has done good work. He tested several incubators last spring, and was fairly successful; but the results were not so satisfactory as we expected. There were too many dead chickens. He is now living quite close to the poultry buildings, and intends to conduct further experiments along this line. A number of nice young birds were raised during the year, and were sold by auction in October. (See Mr. Jarvis's report in Part XII of this volume.)

Mr. R. F. Holtermann, of Brantford, who has been honored with the highest positions in the gift of the bee-keepers of this continent, was appointed to give lectures and practical instruction to our students at the College, and to do certain experimental work in his own apiary at Brantford. The lectures were given in the spring term, and the experimental work was carried on throughout the season, which, I need not say, was an exceptionally unfavorable one. Nevertheless, Mr. Holtermann made a good beginning on two or three lines of investigation. He did what was possible under the circumstances, and reached certain conclusions which are given to the public in Part XIII of this report. We hope for valuable results from future work in this department.

Bacteriology.

During the year, we have been equipping our new Department of Bacteriology. Mr. F. C. Harrison, our Bacteriologist, ordered the apparatus, etc., in Germany early in the year, and commenced work in his department with a short course of lectures and a considerable amount of practical instruction in the Pasteurization of milk, for the benefit of the students in attendance at the Dairy School from the 14th of January to the 1st of April.

Mr. Harrison spent his summer vacation at special bacteriological work in the University of Michigan, Ann Arbor, Mich., and returned to Guelph at the opening of the College in October. During the Fall term, he has been fully occupied with lectures and laboratory work for our regular third year students in microscopy, bacteriology, vegetable histology, and plant pathology.

Our new bacteriological laboratory is now well equipped, and Mr. Harrison is ready for practical work along several inviting and very important lines. The only question is, can we arrange our programme so that his time will not be all or nearly all taken up in teaching? We must do our best to furnish opportunities for original investigation; for, as civilization advances, we seem to be more than ever exposed to the fatal attacks of disease-producing germs, or certain forms of bacteria, in air, in water, in milk, in everything; and no more important problems can engage the attention of scientific men than those presented for solution in this vast field of research. (See Mr. Harrison's report in Part IX. of this volume.)

Athletic Exercise.

We do not spend much time under this head; but Captain Clarke, our drill instructor, gives every class a certain amount of training in drill and gymnastics, enough to straighten them up and make them stronger, brighter, better looking, and better-mannered men than they are before they pass through his course of training.

Changes in our System of Heating.

At the suggestion of our engineer, Mr. R. W. Green, we decided about a year ago to dispense with five or six separate fires and heat several of the buildings on the College campus by steam conducted in pipes underground, from the College boilers to the build-

ings in question. It was thought by many that the work could not be done successfully; but I am pleased to be able to report that Mr. Green has carried his plans and work to completion and we are heating from the College boilers, with entire satisfaction and a great saving in fuel, the Bursar's house and the Farm Superintendent's residence, both on ground a little higher than that on which the College stands; and the Chemical Laboratory, the Gymnasium, and the new experimental building, all on ground considerably (fifteen or sixteen feet) lower than the boilers. The chief difficulty was with the latter; but Mr. Green's skill overcame every obstacle, and we are now heating all these buildings much better than formerly, with less labor and much less fuel.

Students in Residence.

For an account of the responsibility assumed for students in residence, and some statements of fact as to their conduct and the time spent in looking after their studies, etc., see the report of my Assistant Resident Master in Part II of this volume.

Class-Room Work.

Our class-room work went on as usual during the past year. Ten candidates wrote for the B.S.A. degree. Nine were successful and one was starred in drawing. A fair proportion of the first and second year students gained a respectable standing in our College examinations; but the percentage of failures is still very large, resulting in some instances from idleness but in most cases from a lack of proper training in the elementary branches of an English education.

Examiners.

The third year examinations were conducted by the University of Toronto; and those of the first and second years, by the Professors of the College, with the assistance of the following outside examiners:

Wm. Tytler, B.A. Guelph.....2nd Year Literature.
J. M. McEvoy, B.A., LL.B., London, Ont....Political Economy.
A. W. Campbell, C.E, St. Thomas, Ont.....Road-Making.
W. A. Kennedy, B.S.A., Guelph.....1st Year Chemistry.
R. Harcourt, B.S.A., Guelph.....2nd Year Chemistry.

Bachelors of the Science of Agriculture.

The examinations for the degree of B.S.A. were held in the month of May, and the candidates received their degrees at the commencement exercises of the University of Toronto in June. The list of successful candidates is as follows:

Christian, A. H.....Danforth, York Co., Ont.
Doherty, M. W.....Eglington, York, Ont.
Kennedy, W. A.....Apple Hill, Glengarry, Ont.
King, A. A.....Johnson's Crossing, N. S.
Robertson, G. A.....Kingston, Frontenac, Ont.
Rowe, F.....London, England.
White, E. F.....Clarkesburg, Grey, Ont.
Wiancko, A. T.....Sparrow Lake, Muskoka, Ont.
Widdifield, J. W.....Siloam, Ontario County, Ont.

Recipients of Associate Diplomas.

Twenty-five, having completed our regular course of two years, were examined for associate diplomas. Of these, twenty-four passed in all the subjects. The diplomas were

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resented by his Honor Lieutenant-Governor Kirkpatrick, at our closing exercises on the 29th June; and the names of the recipients are as follows:

Campbell, W. G.	Brantford, Brant County, Ont.
Cass, L. H.	L'Orignal, Prescott, Ont.
Chadsey, G. E.	Sumas, B.C.
Clark, J. F.	Bay View, P. E. I.
Dunn, E.	Plover Mills, Middlesex, Ont.
Edelsten, E. J. M.	London, W., England
Kipp, A.	Chilliwack, B.C.
Knight, J. W.	Elginburg, Frontenac, Ont.
Lang, L. W.	St. Marys, Perth, Ont.
McCallan E. A.	St. David's, Bermuda.
Maconachie, G. R. B.	Gurdaspur, Punjab, India.
McCullough, H. A.	Nantyr, Simcoe, Ont.
McGillivray, J. W.	Sumas, B. C.
McPhail, J. D.	Vernon, Carleton, Ont.
Paterson, T. F.	Lucknow, Bruce, Ont.
Payne, G. Y.	Peterborough, Peterborough, Ont.
Smith, G. A.	Morrisburg, Dundas, Ont.
Smith, P. B.	Hamilton, Bermuda.
Taylor, W. H.	Peterborough, Peterborough, Ont.
Thompson, W. J.	Barrie, Simcoe, Ont.
Tye, C. W.	Haysville. Waterloo, Ont.
Whetter, J. R.	Lorneville, Victoria, Ont.
Wilson, A. C.	Greenway, Huron, Ont.
Wilson, N. F.	Rockland, Russell, Ont.

First-Class Men.

The work in the College is divided into five departments; and all candidates who get an aggregate of seventy-five per cent. of the marks allotted to the subjects in any department, are ranked as first-class men in that department. We would like to have a larger number of such men, but we are determined that none shall be so ranked unless they really deserve it. The following list contains the names of those who gained a first-class rank in the different departments at the examinations in 1895, arranged alphabetically:

First Year.

1. Devitt, I. I., Floradale, Waterloo Co., Ont., in three departments: Agriculture, English Literature, and Mathematics.
2. Gadd, T., Varney, Grey Co., Ont., in one department: Agriculture.
3. Higginson, O. G., Hawkesbury, Prescott Co., Ont., in one department: Agriculture.
4. Hodgetts, P. W., St. Catharines, Lincoln Co., Ont., in four departments: Agriculture, Natural Science, English Literature, and Mathematics.
5. Reinke, B. F., Ancaster, Wentworth Co., Ont., in one department: Veterinary Science.

Second Year.

1. Clark, J. F., Bay View, Prince Edward Island, in five departments: Agriculture, Natural Science, Veterinary Science, English Literature, and Mathematics.
2. Knight, J. W., Elginburg, Frontenac Co., Ont., in one department: Agriculture.
3. Lang, L. W., St. Marys, Perth Co, Ont., in four departments: Agriculture, Natural Science, Veterinary Science, and English Literature.
4. Paterson, T. F., Lucknow, Bruce Co., Ont., in four departments: Agriculture, Natural Science, Veterinary Science, and English Literature.

Medallists.

Medals are given to the three students who rank highest in general proficiency in the theory and practice of the second year. The following were the successful competitors in 1895 :

Gold Medallist. J. F. Clark, Bay View, Prince Edward Island.

First Silver Medallist. L. W. Lang, St. Marys, Perth, Ont.

Second Silver Medallist. T. F. Paterson, Lucknow, Bruce, Ont.

THE GEORGE A. COX SCHOLARSHIPS.

First Year.

1. *Agriculture, Live Stock, Dairying, Poultry, and Apiculture.* O. G. Higginson, Hawkesbury, Prescott, Ont.
2. *Natural Science.* P. W. Hodgetts, St. Catharines, Lincoln, Ont., first in two departments.
3. *Veterinary Science.* B. F. Reinke, Ancaster, Wentworth, Ont.
4. *English.* Not awarded.
5. *Mathematics.* I. I. Devitt, Floradale, Waterloo, Ont.

Second Year.

1. *Agriculture, Live Stock, Dairying, Poultry, and Apiculture.* 1st, J. F. Clark, Bay View, P.E.I., first in five departments; 2nd, J. W. Knight, Elginburg, Frontenac, Ont.
2. *Natural Science.* T. F. Paterson, Lucknow, Bruce, Ont.
3. *Veterinary Science.* Not awarded.
4. *English.* L. W. Lang, St. Marys, Perth Ont.
5. *Mathematics and Physics.* Not awarded.

PRIZE MEN.

First Year.

Agriculture, Live Stock, Dairying, Poultry and Apiculture. 1st, O. G. Higginson; 2nd, I. I. Devitt.

Natural Science. 1st, P. W. Hodgetts; 2nd, I. I. Devitt and O. G. Higginson.

Veterinary Science. 1st, B. F. Reinke; 2nd, O. G Higginson.

English Literature, Grammar, and Composition. 1st, P. W. Hodgetts; 2nd, I. I. Devitt.

Mathematics and Bookkeeping. 1st, I. I. Devitt; 2nd, P. W. Hodgetts.

General Proficiency. 1st, P. W. Hodgetts; 2nd, I. I. Devitt; 3rd, O. G. Higginson; 4th, Wm, M. Shields, Glasgow, Scotland; 5th, B. F. Reinke; 6th, J. T. Guy, Columbus, Ontario Co., Ont., and J. R. Oastler, Featherstone, Parry Sound District, Ont.

Second Year.

Agriculture, Live Stock, Dairying, Poultry, and Apiculture 1st, J. F. Clark; 2nd, T. F. Paterson.

Natural Science. 1st, J. F. Clark; 2nd, L. W. Lang.

Veterinary Science. 1st, J. F. Clark; 2nd, L. W. Lang.

English Literature and Political Economy. 1st J. F. Clark; 2nd, L. W. Lang.

Mathematics and Physics. 1st, J. F. Clark; 2nd, L. W. Lang.

General Proficiency. 1st, J. F. Clark, 2nd, L. W. Lang; 3rd, T. F. Paterson; 4th, E. A. McCallan, St. David's, Bermuda; 5th, J. W. Knight.

Valedictory Prize.

A prize of ten dollars in books is offered annually to the second-year students for a valedictory address. The subject last year was "Science in Farming," and the prize was awarded to T. F. Paterson, of Lucknow, Bruce county, Ont.

Closing Exercises.

Our closing exercises took place on Saturday, June the 29th. The weather was very pleasant and the attendance of visitors was large. His Honor, Lieutenant-Governor Kirkpatrick, favored us with his presence, and everything passed off very pleasantly. The College diplomas were presented by the Governor, and interesting addresses were delivered by His Honor and the Hon. John Dryden. Major Mutrie, M.P.P., and a number of other gentlemen from Guelph and the surrounding country assisted in the presentation of medals, prizes, and honor certificates.

Visitors.

We had a large number of visitors as usual in the month of June—not less than 10,000. Some drove in from the surrounding country, but most of them came by the Grand Trunk Railway.

Financial Statement.

For a statement of the revenue and expenditure of the different departments, see Appendix V. to this report. It will be observed that the total unexpended balances on the year's operations in all departments was $6,222.28.

Conclusion.

With the addition of our new experimental building, I think I may say that never before were we so well equipped for work in the different departments of the institution as we are at the present time. We have the principal buildings which we require, and our appliances for practical work are nearly all that we need for the students now in attendance.

JAMES MILLS,
President.

PART II.

REPORT OF

ASSISTANT RESIDENT MASTER.

To the President of the Ontario Agricultural College :

SIR,—I beg herewith to report on my duties as Assistant Resident Master.

COLLEGE RULES.

The rules in residence are few and simple. We have no rules, the observance of which, by any student, is not of direct benefit to himself and to his fellow students, and conducive to the welfare and good repute of the College. The most important of these rules are as follows :

1. Regarding attendance at roll-call and prayers.

Every morning, before going to lectures, the students are required to assemble in the class-room for roll-call. After roll-call a Bible selection is read, and a prayer offered. It is due to the students to say that, without exception, the most respectful and reverential silence is observed on every occasion, during prayers.

2. Regarding afternoon study.

Each afternoon, from 1.30 to 4.00, while one half of the students are at work, the other half assemble in the class-room for study. They are there under the charge of an officer, either myself or your Secretary, Mr. G. A. Putnam. As a rule the second year students have practical instruction in some one of the departments during the afternoon. Sometimes, also, a student wishes to study specimens in botany, biology, or veterinary science in the museum or elsewhere ; and if good faith is assured, he is allowed to do so.

This assembling for study in the afternoon not only provides a quiet study-room for those who are studiously inclined, but it also leads some to spend the two and a half hours in study, who would not otherwise do so.

3. Regarding evening study.

Each evening during the week, except Friday evening, promptly at seven o'clock, the students are required to go to their rooms for study, and to remain there until half-past nine. Late in the spring, the hour for going to the rooms is changed to half-past seven. This period in the evening affords another opportunity for study ; and, as a matter of fact, this is the time when most of the studying is done. Many students utilize all possible opportunities for study ; but all study, more or less, during this period from 7.00 to 9.30 p.m. An officer is in charge every evening, to see that proper quietness is maintained in the halls and dormitories.

4. Regarding leave of absence from College.

Our rules relating to leave from College are extremely reasonable, affording as much liberty as any student can possibly require, for legitimate needs. These periods are, Friday evening, Saturday afternoon, two or three afternoons a week, after study, from four till six, and one evening during the week, besides Friday. For this one evening, any student wishing to be excused from study, must report to that effect to the officer on duty and have his name entered on the register as excused. He is expected to report to the night watchman not later than 10.30 unless he obtains special permission to stay later. I notice by the register that, while a few students avail themselves regularly of this free evening, the majority of students are content with Friday evening and the hours in the afternoon available for business and social recreation.

5. Regarding attendance at church.

Every student of the first and second years is required to attend church on Sunday morning. No restriction is placed upon his choice. Anyone unable to go must report at the reception room at nine o'clock on Sunday morning, to be excused from attendance. The following morning at roll-call, attendance at church is marked in the register, each student reporting for himself.

6. Regarding general conduct.

With regard to general discipline, the method pursued here is a minimum of coercion with a maximum of self-government. From the beginning of their College course, these principles of conduct are inculcated: To do nothing in the College detrimental to the interests of their fellow students, such as making any kind of disturbance when others are at study, or interfering with one another's belongings; to do nothing outside likely to bring discredit on the College; and to conduct themselves at all times and in all places as manly, self-respecting *men* Whatever rules we have, written or unwritten, are comprehended in these injunctions, and are referred to these as their *raison d'être.* I wish to say, with regard to this method of discipline, that I have found the students truthful, honorable, and self-respecting. Whatever may now and then be done in a thoughtless or mischievous mood, an appeal to their honor and truthfulness, and to their respect for one another's rights, is seldom made in vain.

With regard to self-government among students, I wish to call your attention to the matter of the College reading-room. Two years ago, when I assumed my present duties here, the reading-room was not a reading-room properly, but rather a lounging and conversation room; a general place of resort after meals, to while away half an hour in pleasant chat before going to work or to study. It seemed to me that a reading-room could not be made to serve two such opposite functions. I appealed to the Literary Society (which represents the whole student body), to take the matter in hand, and to make it properly a reading-room, where silence should be at all times observed. They did so. Regulations were adopted, curators were appointed to take charge of the room, and at the same time the obligation resting upon themselves to respect these regulations was realized. The consequence is that now, instead of being, as formerly, a half lounging, half reading-room, it bears the appearance, at all times, of a respectable college reading-room. The results are certainly far more satisfactory in every respect, than could have been obtained by coercive measures, however reasonable. There would be now no difficulty in keeping the room perfectly quiet, if there could be provided, within the College building, a room where those who do not wish to read might retire for a few minutes' conversation after supper. As it is now, there is certainly a great temptation to drop into the reading-room to meet and converse, there being no other place. It is to be hoped that this long-felt want will soon be met.

While, owing to the general good character and orderly habits of our students, the demand for disciplinary action is but little, yet the position of Resident Master is no sinecure. A great deal of time is necessarily taken up by the constant duties of the position. First, an hour and a half every day in charge in the dining-room; Secondly, two hours and a half on three afternoons a week, in charge of students in the class room;

Thirdly, time of evening duty, a part and sometimes nearly all of the study hour, three times a week; Fourthly, the time required for inspection of the rooms, furniture and halls, which should be done at least twice a week; Lastly, the time taken in dealing with cases of infringement of rules, which, I am very much pleased to report, is not great. If to this work and consequent worry, be added the duties of teaching, of which at present a large share falls to me, and the time required to prepare for that teaching, it will be seen that the Resident Master need not be idle.

Work in Physics.

In this the first report from the Department of Physics, a brief statement concerning its growth and the present condition of its equipment will be first in order.

On commencing the teaching of physics here, in October, 1893, I found no class-room or laboratory devoted specially to that department, and only a few dollars' worth of apparatus. In the beginning of the year 1894, about 60 dollars' worth of apparatus was purchased. Professor Shuttleworth kindly allowed the use of his class-room, where water and gas were available for experiments during lectures. There the lectures and experiments in physics have been carried on, until this last term. As the agricultural building, erected during the past summer, contains a new live stock class-room, the old class-room in the College was no longer needed for lectures in that subject, consequently it has been fitted up as a class-room and laboratory for physics, making a large, well lighted, and commodious room. Large work tables, supplied with drawers and cupboards underneath, and gas and water taps above, have been fitted up, giving accommodation for experimental work to twenty students at once. A room adjoining this class-room may be used as a combined office and storeroom, and capacious shelves have been built therein by the College carpenter, for the storing of apparatus.

In addition to these rooms, where general physics is intended to be taught, room has been provided in the new agricultural building for physical investigations bearing more directly upon agriculture. This provision marks a very important step in advance, as no original investigation in this direction has yet been done here, while much might be done of great importance to agriculture, as instanced by the work of Professor King of Wisconsin.

With ample accommodation, there is now needed a stock of apparatus, by means of which this subject can be properly and successfully taught. There is none at all at the laboratory for agricultural physics. In the other laboratory, in addition to the stock previously on hand, apparatus to the value of $250 was purchased last fall. That is a very good start, and now if a liberal grant for the first stock can be procured, and after that a small yearly grant for replenishing, the department of physics will be in a position to do good work, educationally and practically.

Lectures.

The ground covered by the lectures during each term is as follows:

The work commences in the second year of the College course.

Fall Term. Statics and dynamics, embracing the following: (1) Physical forces, energy, power, work. (2) Mechanics, being chiefly a study of the simple machines, (*a*) the lever, including the lever proper, balances, weigh scales, the wheel and axle, belt machinery and cog machinery; (*b*) the pulley, different systems, with their advantages and disadvantages; (*c*) the inclined plane, including the wedge, the screw, the tread-power, drawing loads up different grades.

Winter Term. Hydrostatics and hydro-dynamics, being a study of the physical properties of gases and liquids; the theory of pumps and syphons; the theory and construction of thermometers and barometers; and capillarity, including the movement of water in soil.

Spring Term. Same subject continued, with special reference to the effect of *heat* on gasses and liquids.

Practical Work.

During the past term, the regular lectures have been supplemented by a course of experiments in mechanics, carried on under my personal supervision, the students working in turn at the different machines. The experiments to be performed were specified, and each student was required to present a report of his work and results obtained. This practical work will be continued throughout the year. In the spring term, work in determining levels with the theodolite aud measuring area with the chain will be given.

Special Course in Electricity for the Third Year.

That very important branch of physical science, electricity, has not been touched upon in our course in physics, until this year. A special course in electricity has been arranged for those third year students who have chosen chemistry as their specialty. This work has been taken once a week, on Saturday forenoons (no other time being available), and the line pursued has been, not the study of curious electrical phenomena, but the study of the application of electricity to man's needs. This course will have covered, by the end of the present academic year, the study of the telephone, the telegraph, electric lighting, electroplating, and locomotion by electricity. Thus far it has been entirely practical, each student manipulating the instruments and investigating the phenomena for himself, with only such lectures as were necessary to call attention to and explain special difficulties, and with supplementary reading in such text-books as were available. I might say just here that the library is not well supplied with books on physics, only a very few being on hand.

It is my intention, with your consent, to give the second year class some elementary work in electricity, with a view to imparting a knowledge of its application to mechanics and the arts. This will leave the third year free to pursue a more advanced course, whereas this year they had to begin at the beginning of the subject. Besides, electricity is now such an important factor in the industrial and mechanical world, that it can no longer be omitted from a course in physics that makes any pretensions to being practical and comprehensive. In fact, intelligent people will not much longer remain in ignorance of the theory of electrical machinery and the transmission of electrical energy.

In conclusion, I wish to express my thanks to you for the commodious quarters that have been provided for this department, and also for the liberal allowance made for the purchase of apparatus. With such a good beginning, there is every reason to hope that this branch of science will, in future, receive its due attention.

Work in English.

The course in English extends throughout the three years, and consists of three parts, as follows:

(1) Study of English authors.

(2) Study of Grammar, Rhetoric, and History of English Literature.

(3) Original compositions and essays.

In the first year, the selections taken this last term were (1) Poetical selections from Palgrave's Golden Treasury of Songs and Lyrics; (2) Scott's "Talisman." The points emphasized in the study of the poetical selections were: the peculiarities of poetic expression; searching into the true meaning of each selection, in detail and as a whole, and committing to memory passages of special beauty of thought or expression. Occasionally a poem formed or suggested a theme for a short essay, by way of paraphrase, comment, or criticism. In the Talisman, the study of the history of the period represented, the end of

the twelfth century, was taken briefly, with the social and political conditions of that age as contrasted with those of our own time. Then the characters and chief incidents of the novel were discussed, and a thorough understanding of the story was aimed at in the writing of a number of essays describing these characters and narrating the most striking and dramatic incidents in the story.

The historical novel, as a selection for class-study, has many advantages. First, it possesses, for the average student, an interest superior to that of the formal essay. Secondly, being more diffuse, it affords much greater exercise in reading for the same amount of mental effort, and exemplifies the easy swing of the narrative style of composition, the mastery of which is so desirable an accomplishment. Lastly, it suggests an unlimited number of subjects for composition, furnishing as it does, all the data required as far as ideas are concerned, and thus affording excellent practice in arranging and expressing those ideas.

The work in Grammar, which extends throughout the year, needs no comment, it being a review and a continuation of the Grammar taught in the Public and High Schools of this Province, with special emphasis, however, on sentence-structure and punctuation.

During the winter and spring terms, the poetical selections from Palgrave will be continued. For prose, Washington Irving's Sketch Book will be read. The Sketch Book affords considerable variety of choice, as it contains examples of the narrative, the descriptive, and the argumentative styles. The easy, graceful language of the author, with his nice choice of words and his perfect sentences, makes the reading of these essays both a pleasure and a profit. The method of study will be, of course, much the same as that pursued with the Talisman.

Having explained fully the methods pursued in teaching Literature to the first year, I have to state, for the other years, only the list of selections, as the methods remain substantially the same, allowance being made, of course, for the increased literary knowledge and ability that have been acquired by the more advanced classes. Less attention to details and more attention to criticism and comparison, constitute the chief differences. The selections for the second year are as follow:

Fall Term. Shakespeare's "Julius Cæsar," and three essays from "Representative Essays," Carlyle's "History," Emerson's "Compensation," and John Morley's "Popular Education."

Winter Term. Shakespeare's "Richard III.," Blackmore's "Lorna Doone," and one or two of the Representative Essays.

Spring Term. Tennyson's "Locksley Hall," and "Sixty Years After."

During the last term eight essays were written by the second year class on subjects suggested by their studies in literature. These essays were evaluated, and the marks given will aid in fixing their relative standing for the term's work.

The third year work in English is as follows:

1. Representative selections from the following representative authors: Shakespeare, Bacon, Milton, Pope, Addison, Macaulay, Wordsworth, Tennyson, Froude, Arnold, Irving, Morley.

2. History of English Literature, being chiefly a study of the lives, works and peculiarities of the above-mentioned authors.

3. The writing of impromptu compositions in class; exercises in rhetoric.

4. The writing of six original essays on subjects assigned them. These are intended as tests of their ability to write correctly in English, and will be marked very closely.

By way of general comment on the literary ability and acquirements of our students, and also on their endeavors, I cannot do better than to quote a sentence or two from the report sent in by Mr. Tytler, who examined the second year in Julius Cæsar at Christmas. "With only a few exceptions they show a very intimate knowledge of the play, and it is evident to me that they must have given no little time and study to the prepara-

tion of the work. Where they come short is in want of ability to express their ideas in good literary English, and, in some instances, of ability to spell. Both these defects are, of course, due to inadequate preparation and training, before coming to you."

After two years' experience in teaching English here, I have come to this conclusion: In order that our students may acquire, in two or three years of study, the power to speak and to write with tolerable facility and correctness, they must first read widely from the best English authors. This will widen their vocabulary and enlarge their ideas, besides giving them models of style which, through unconscious imitation, will more or less be adopted by them. Secondly, they must write much, and their errors and defects must be pointed out to them. I have endeavored to fulfil both these conditions, and the latter has given me considerable labor in correcting their compositions. A great deal more time than I have been able to give, might with profit be devoted to this part of English teaching.

Respectfully submitted,

J. B. REYNOLDS

PART III.

REPORT OF THE

PROFESSOR OF BIOLOGY AND GEOLOGY.

To the President of the Ontario Agricultural College:

SIR,—The closing days of 1895 bring to an end one of the most pleasant years of work, since my connection with the College began. The change in the curriculum of studies, by which more time is devoted to work in the laboratory, has made the teaching of science much more interesting and attractive. No subjects of study appeal more to the eye than those in the departments of science, and hence arises the necessity for making a free use of diagrams, and as far as possible of the objects themselves. Hitherto, our course has been so arranged, that there was not time to emphasize the work of the laboratory, but additions to the staff and a change in the curriculum by which students of the third year can specialize, have enabled us to make marked progress in the line of practical instruction this year. Below is an outline of what has been done in the department of biology.

1. WORK IN LECTURE-ROOM AND LABORATORY.

First Year. The first six weeks of the fall term are devoted to the study of biology, and the remainder to that of zoology. The winter term is occupied by a continued study of zoology and also a course of lectures on geology, as it relates to agriculture. The spring term is spent in gaining a knowledge of botany. In the study of this subject, a specimen of plant is brought into the class room for each lecture, and used in practical instruction relating to the analysis and identification of plants.

Second Year. The fall term is devoted to entomology. To aid in this study, an excellent collection of insects in the various stages of development (larva, pupa and imago) is used and is accessible to the students at any time they wish to examine it.

The afternoons of two days in each week are spent in the very careful analysis of plants and the drawing of characteristic parts. During the winter term, practical work, two afternoons a week, continues, attention being given to the microscopic structures in plants. Botany is taken up in the lecture-room during the spring term, and two afternoons weekly are spent in further practical study of plant analysis and in the mounting of twenty-five species of plants. The work done this year has been very creditable.

Third Year. During the fall term a course of lectures in structural and physiological botany is given, and also lectures on geology with special reference to the rock formations found in Ontario and their economic products.

Two afternoons are occupied in a practical study of zoology and plant physiology. The theoretical course in botany and geology is continued through the winter term and four afternoons spent in the laboratory, three in practical botany, and one in zoology.

As the examinations of third year students commences early in May no regular course is laid out for work in the spring term, but the time is spent in what seems best for the students' success. During the third year students making a speciality of biology require to mount one hundred species of plants.

2. The Museum.

As curator of this adjunct to teaching, it is my duty to make a slight reference to its condition. So many improvements in College accommodation have been going on from year to year, that I have never asked much for this room, believing that ere long an opportunity would present itself, after some much needed additions to the College were made.

I think the time has now arrived when we may reasonably ask for a few cases of more modern construction than those now used in the museum, and I would therefore suggest to you to ask for a grant of three hundred dollars for the purpose of getting a few new cases and some additional specimens. As we are now emphasizing the study of zoology, we require further means for illustration both in specimens and accommodation for them.

We require to keep before us the fact that our work is the instruction of students, rather than an arrangement to please the eye of the ordinary visitor. During 1895, we have received a few donations:

1. From Alexander Thoman, Arkona, a case of stuffed birds, skilfully prepared and mounted in a very attractive manner.
2. From Alexander McKenzie, sr., Guelph, some Indian implements.
3. From P. Kennedy, B.S.A., some fossils.
4. From Percy Tavernier, Guelph, two stuffed birds.
5. From James Hill, Wellandport, Indian implements.

3. Practical Work.

Early in the year the following "Spraying Calendar" was issued, and a bulletin on "Poisonous Plants" was prepared. In reference to the latter, it was thought better to defer its publication until near spring, when readers are more likely to observe plants and make use of such information as it contains.

SPRAYING CALENDAR.

Plant.	First application.	Second application.	Third application.	Fourth application.	Fifth application.
1. *Apple* ..... Scab, codling moth, bud moth.	Copper sulphate, about the time buds are swelling.	Bordeaux, just before blossoms opens; Paris green for bud moth, when buds open.	Bordeaux and Paris green, when blossoms have fallen.	9-12 days after, Bordeaux and Paris green.	Bordeaux 10-15 days later.
2. *Pear* .... Leaf blight, scab, codling moth.	Copper sulphate when buds are swelling.	Bordeaux just before blossoms open.	Bordeaux and Paris green, after blossoms have fallen.	9-12 days after, Bordeaux and Paris green.	Bordeaux 10-15 days later.
3. *Plum* .... Rot, etc., and curculio.	Copper sulphate before buds open.	Bordeaux and Paris green as soon as blossoms fall.	9-12 days after Bordeaux and Paris green.	Bordeaux 10-20 days later.	Ammoniacal copper carbonate 10-20 days later.
4. *Cherry* .... Rot, aphis, slug.	Bordeaux as the buds are breaking. If aphis appears, kerosene emulsion.	Bordeaux, when fruit has set; for slugs, dust leaves with air-slaked lime. Hellebore also good against slug.	Bordeaux, 10-15 days after, if rot appears.	Ammoniacal copper carbonate 10-15 days later.	
5. *Peach* .... Rot, mildew.	Copper sulphate before buds swell.	Bordeaux before flowers open.	Bordeaux, when fruit has set.	Ammoniacal carbonate when fruit is nearly grown.	Repeat fourth 5-10 days later.
6. *Grape* ..... Mildews, etc., flea bettle.	Copper sulphate, when buds swell. Paris green for flea bettle.	Bordeaux, when leaves 1½ inches in diameter; Paris green for beetle.	Bordeaux, when flowers have fallen. Paris green for beetle.	Bordeaux 10-15 days later.	Bordeaux 10-15 days later if disease still appears.*
7. *Raspberry* .... Anthracnose, rust.	Copper sulphate before buds break.	Bordeaux, if rust appears during summer.	Bordeaux, if the trouble appears to continue.	The only remedy, as yet, for orange rust is to cut out diseased plants.	
8. *Currant* ..... Worms and mildew.	Paris green or hellebore for worms.	Hellebore 10 days later for worms; Bordeaux for mildew.	Hellebore if necessary for worms.		
9. *Gooseberry* ..... Mildew and worms.	For mildew Bordeaux as soon as leaves expand. Hellebore for worms.	Bordeaux 10-15 days later. Worms as before.	Ammoniacal copper carbonate 10-15 days later.	If further treatment is required for mildew, repeat third 10-15 days later.	
10. *Tomato* .... Rot, blight.	Bordeaux, as soon as rot or blight appears.	Bordeaux, if trouble continues.	Bordeaux if necessary.		
11. *Strawberry* ... . Rust.	Bordeaux when first fruits are setting.	Ammoniacal copper carbonate when first fruits are ripening.	Bordeaux, when fruit is taken off.	Bordeaux if trouble continues.	
12. *Potato* ..... Blight, bettles.	Paris green as soon as beetles appear.	Bordeaux, when plants about six inches high.	Bordeaux 10-15 days later.	Repeat if necessary in 10-15 days.	
13. *Cabbage*	Pyrethrum may be applied in solution or dusted on, 1 part pyrethrum to 6-8 parts flour.				

* If further applications are necessary use ammoniacal copper carbonate.

SOLUTIONS RECOMMENDED.

1. *Copper Sulphate Solution.*

Copper sulphate	1 pound.
Water	20 gallons.

To be used only before the buds burst, and never to be applied on the foliage. When applied to peach trees, use 25 gallons of water instead of 20 gallons.

2. *Bordeaux Mixture.*

Copper sulphate	5 pounds.
Lime (fresh)	4 pounds.
Water	40 gallons.

Suspend the copper sulphate in five gallons of water. This may be done by putting it in a bag of coarse material and hanging it so as to be covered by the water. Slake the lime in about the same quantity of water. Then mix the two and add the remainder of the 40 gallons of water. Warm water will dissolve the copper sulphate more readily than cold water. If the lime is at all dirty, strain the lime solution. Use wooden vessels.

3. *Ammoniacal Copper Carbonate Solution.*

Copper carbonate	1 ounce.
Ammonia, sufficient to dissolve the copper carbonate.	
Water	9 gallons.

The copper carbonate may be dissolved and kept on hand to dilute when necessary.

4. *Paris Green Mixture.*

Paris green	1 pound.
Water	200 to 300 gallons.

Use about 200 gallons of water for apple trees, 250 for plum trees, and 300 for peach trees. When used upon peach trees, add 1 pound of lime to the mixture. When Paris green is added to the Bordeaux mixture to form a combined insecticide and fungicide, add 4 ounces to every 50 gallons of the Bordeaux mixture.

5. *Hellebore.*

White hellebore (fresh)	1 ounce.
Water	3 gallons.

6. *Kerosene Emulsion.*

Hard soap	½ pound.
Boiling water	1 gallon.
Coal oil	2 gallons.

After dissolving the soap in the water, add the coal oil and stir well for 5 to 10 minutes. A syringe or pump will assist much in this work. Dilute with from 9 to 15 parts of water.

7. *Pyrethrum.*

Pyrethrum powder (fresh)	1 ounce.
Water	4 gallons.

NOTES.

1. When there is danger of disfiguring fruit with the Bordeaux mixture, use the ammoniacal copper carbonate solution.

2. Paris green and Bordeaux mixture may be applied together as well as separately, and thus save time.

3. Paris green is to be used for insects that *chew* the leaves, and kerosene emulsion for those that *suck* the juices of plants.

4. Prepare the mixtures well, apply them at the proper time, and be as thorough as possible in the work.

During 1895 attention was given to several investigations to which reference is now made.

(*a*) Oyster-shell Bark-louse. (*Mytilaspis pomorum.*)

Experiments have been carried on for the past two years to test the efficiency of kerosene emulsion upon this pest. Six infested trees were selected in a young orchard; five were treated and one omitted.

The following treatment was adopted: A solution was made from *one* quart soft soap in *two* quarts of water; and when it was heated and well mixed, one part of crude carbolic acid was added to seven parts of the above solution. This solution was applied to the trunk and large limbs in early spring. An old scrubbing brush was used to rub it on the trees. The application had an excellent effect upon the vigor of the trees and gave the bark a very healthy appearance. In order to ascertain, when the young lice would move out from beneath the scales, a badly infested branch was kept in the laboratory and examined from time to time about the end of May. In 1894 they appeared June 5, but did not show themselves until June 12, 1895, and were a week later in appearing upon the trees of the orchard. As soon as this was observed we at once sprayed the trial trees with kerosene emulsion, diluted with *nine* parts water, and made a second application nine days later.

An examination of the trees in October of 1894 showed very few scales on the wood of that year; and a further examination in October, 1895, showed that the lice had made no headway upon the shoots of this year. Some twigs showing the growth for three years are very instructive The first growth has many lice; second, very few; and the third, none at all. This shows that kerosene emulsion applied at the time the lice are moving and again in about a week after, destroys the pest. Care should be exercised in planting out young trees to observe that they are free from bark-lice; and if not, to treat them as above. Where trees are large and the bark-louse has a good foothold, the work is difficult; but, even under such conditions, we believe the use of kerosene emulsion will be followed by good results.

(*b*) Injurious Fungi.

Some experiments in the use of fungicides have also been conducted during 1895.

The results were not so marked as on former occasions. This no doubt was owing to the season, which was unfavorable to the development of fungi. The following notes from my diary referring to the weather may be of interest in this connection:

April 17th.—First really spring weather, and warm days continue with little or no rain until the 21st.

May 12th.—Cold weather and some snow. On the 13th severe frost and much damage done vegetation. Snow on the 14th and considerable frost. 20th, temperature 25° F.; and on the 21st, 22° F. On the 23rd, a return to warmer weather; but on the 26th and 27th, cool. 29th, very warm.

June 4th, 5th, 6th, cool and necessary to have a fire in the greenhouse. This peculiar spring was followed by a dry summer, and hence was unfavorable to fungoid growth.

I have no doubt that the general report of experiments upon spraying this season will be somewhat disappointing as compared with those of other seasons more suitable for the growth of fungi.

Anthracnose, the Raspberry. (*Glœosporium venetum.*)

To test the effect of fungicides on this blight, 84 plants were selected and a patch where there was considerable anthracnose. Seventy-two were treated and twelve omitted.

The solutions used were:

a. One pound copper sulphate dissolved in 20 gallons of water.

b. Bordeaux mixture, consisting of 5 pounds copper sulphate, 4 pounds lime in 40 gallons of water.

c. Copper carbonate, 1 ounce in 9 gallons of water.

First application, April 23rd, with (*a*) solution.

Second application, May 9th, with Bordeaux mixture.

Third application, May 24th, with Bordeaux mixture.

Fourth application, June 8th, with a solution of copper carbonate, 1 ounce in 9 gallons of water.

An examination on July 4th indicated that the unsprayed bushes showed some signs of the disease, but the sprayed none. At the close of the season very little appeared on the sprayed and not a very marked attack on the unsprayed.

Leaf-spot on the Currant and Gooseberry. (*Septoria ribis.*)

To test the use of fungicides as a preventive of this trouble, 166 plants were selected, most of which had shown much spot in 1894.

The solutions used were the same as in the preceding experiment.

First application, April 23rd, copper sulphate solution.

Second application, May 9th, Bordeaux mixture as above.

Third application, May 24th, Bordeaux mixture as above.

Fourth application, June 8th, copper carbonate solution.

On July 4th some spots appeared on the unsprayed and in a very few caes on the sprayed. The foliage upon the sprayed bushes was much darker and quite conspicuous, as compared with that on the unsprayed. It was also noticed that the unsprayed were badly attacked by the currant worm (*Nematus ventricosus*), while the sprayed were not touched. Another season we purpose trying to what extent the Bordeaux mixture is useful against the ravages of this insect upon upon the foliage of the currant. An examination at the close of the season showed that the spraying had been helpful, but not in a marked degree, as the fungus had not made much headway upon the unsprayed bushes.

(*c*) Transpiration of Plants.

For some time my attention has been directed to the injuries sustained from weeds, with a view to discuss the subject before farmers' institutes. Amongst those I refer to is the damage done by them in using water which should be taken up by other plants of greater value. The water absorbed by weeds is very great. This passes up through the plant and a large amount of it is evaporated from the surface of the leaves. I believe one of the worst features in weeds is the waste of water which should be used in the growth of plants that are being cultivated.

With a view to find out how much water is thrown away in this manner, two species of plants were selected, the common Wild Mustard (*Brassica sinapistrum*) and the Pigweed (*Amarantus retroflexus*). These were put into large pots and placed in the garden in about the same conditions as we might expect in the field. Side by side with them, were pots filled with the same soil and submitted to the same conditions, but they contained no plants.

Water was applied as required, and the pots were weighed at regular intervals. The pots containing plants always weighed less, for the water had been absorbed by them and evaporated from their leaves.

The experiment was continued for nine days, when rain interfered and other conditions unfavorable to a continuance of the experiments.

The following figures will show the amount of water used each day by the plants under investigation :

	Wild Mustard. Ounces.	Pigweed. Ounces.
July 17th. Warm, dry, windy	10.87	8.12
" 18th. Hot, with a little wind	10.67	7.65
" 19th. Rain.		
" 20th. Sultry, with a little wind	12.33	10.13
" 21st. Sultry and cloudy	7.02	6.62
" 22nd. Dry and bright, with some wind	16.75	13.8
" 23rd. Fair and bright, with light wind	19.5	13.8
" 24th. Somewhat cloudy but fine	15 35	10 75
" 25th. Bright, with a little rain	14.6	12.9
" 26th. Bright, with a little breeze	18.8	10.8
9 days	125.87	94.57
Average per day	13.98	10.51

From this it appears that an average mustard plant pumps daily from the soil fourteen ounces, almost one pound, of water, or equivalent to seven-eighths of a gallon.

Allowing ten mustard plants to a square yard we have twenty-one tons of water, or 4,235 gallons thrown off daily from an acre into the atmosphere, a most extravagant use of water, especially in a dry season.

In the experiment water was supplied, but not in excess. No water was put directly into the pots, but into the pans in which the pots stood. The pots were weighed morning and evening.

An examination of the pots on the 16th, 19th and 27th, all rainy days, showed the daily average to be, for the mustard 7.75 ounces and the pigweed 3.33 ounces.

We purpose continuing investigation in this direction so as to show conclusively the pernicious effect weeds have in robbing the soil of moisture.

(*d*) "Tree Protectors."

Last year we undertook some experiments showing to what extent the funnel-shaped "tree protector" entrapped the codling moth.

The average upon each of twenty-five trees in 1894 numbered twenty-five worms beneath each protector. For 1895 the average for twenty three tree was only six per tree.

In the old orchard the average for ten trees was 11, while in the young orchard it reached an average of only two for thirteen trees. This marked diminution in the number may be accounted for by spraying having been done more thoroughly in 1895 than in 1894, and also by the poor crop of apples obtained this season.

(e) Roots of the Canadian Thistle.

The question having arisen to what extent a thistle root will grow, if cut into pieces, the following investigations were undertaken to get some information upon the subject :

a. The root was cut into pieces 2 inches in length.

b. " " 1½ "

The cuttings were taken from the crown down, planted in pots and placed in the propagating house. The plants from which the roots were taken were about nine inches high and had formed no flower buds.

a. Result 1st, 2 inches, 1 produced 4 buds, 1 failed.
2nd, 2 " 1 " 3 " 1 "
3rd, 2 " 1 " 2 " 1 "
4th, 2 " 1 " 3 " 1 "

b. Result 1st, 1½ " 1 " 4 " 2 "
3rd, 1½ " 2 " 5 " 1 "
4th, 1½ " 2 " 4 " 1 "
5th, 1½ " 2 " 3 " 1 "
6th, 7th, 8th, 1½ inches, all failed to produce a bud.

From these results it seems that if a vertical root is cut into small pieces the pieces will produce buds only as far as the fifth cutting. Sections after that fail to produce buds. This will receive further examination during 1896.

Insects Received and Identified During 1895.

Common name.	Scientific name.
Plum scale	Lecanium.
Vinegar eels	Anguillula aceti.
Pear leaf mite	Phytopus pyri.
Apple tree borer	Saperda Candida.
Canker worm	Anisopteryx pometaria.
Bark beetle	Scolytus rugulosis.
Currant tree borer	Ægeria tipuliformis.
Tapeworm	Tænia cœnurus.
Violet nematode	Anguillula.
Pea bug	Bruchus pisi.
Clover root borer	Hylesinus trifolii.
Strawberry crown borer	Tyloderma fragariæ.
Wire worms	Agriotes communis.
Measuring worm	Amphidasys cognataria.
Cherry tree borer	Dicerca divaricata.
Buffalo carpet beetle	Anthrenus scrophulariæ.
Rose slug	Selandari rosæ.
Thrips	Erythoneura vitis.
Corn leaf hopper	Tettigonia mollipsis.
The Eyed elater	Alaus oculatus.
Cut worm	Hadena devastatrix.
Cecropia emperor moth	Platysamia Cecropia.
Spittle insect	Clastoptera pini.
Ash-colored blister-beetle	Epicauta cinerea.
Black blister beetle	Epicauta Pennsylvanica.
Currant plant-louse	Myzus ribis.
Snout beetle	Sphenophorous ochreus.
Cabbage maggot	Phorbia brassicæ.
Mourning horse fly	Tabanus atratus.
Plant lice	Aphis
Leaf-cutting beetle	Magachile brevis.
Gooseberry midge	Cecidomya grossulariæ.
Black peach aphis	Aphis Persicæ-niger.
Herbivorous lady-bug	Epilachna borealis.
Spinous currant caterpillar	Grapta progne.
Cabbage worm	Pieris rapæ.
Peach tree borer	Ægeria exitiosa.
Grain Aphis	Sphenophora avenæ.
Thorn Aphis	Aphis cratægifolii.
Pear tree slug	Selandria cerasi.
Common grasshopper	Caloptenus femur-rubrum.
Cutworm	Hadena arctica.
Pine borer	Monohammus scrutator.
Tent caterpillar	Clisiocampa Americana.
Tussock moth	Orgyia leucostigma.
Celery caterpillar	Papilio asterias.
Squash bug	Anasa tristis.
Ground beetle	Calosoma calidum.
Fall web-worm	Hyphantri cunea.
Strawberry slug	Emphytus maculatus.
Snowy tree-cricket	Oecanthus nivens.
Horn fly	Hæmatobia serrata.

Plants Identified, 1895.

Wormseed mustard	Erysimum cheiranthoides.
Rein-Orchis	Habenaria virides.
Showy Orchis	Orchis spectabilis.
Fig	Ficus Carica.
Water Arum	Calla palustris.
Labrador tea plant	Ledum latifolium.
Naked mitre-wort	Mitella nuda.
Barren strawberry	Waldsteinia fragarioides.
Star flower	Trientalis Americana.
Twisted stalk	Streptopus roseus.
Clintonia	Clintonia borealis.
Club moss	Lycopodium dendroideum.
Club moss	Lycopodium annotinum.
Coral root	Corallorhiza innata.

Ladies' tresses	Spiranthes.
Mouse ear chickweed	Cerastium vulgatum.
Rein-Orchis	Habenaria orbiculata.
Meadow fox-tail	Alopecurus pratensis.
Dock	Rumex crispus.
Rib-grass	Plantago lanceolata.
Wild sarsaparilla	Aralia racemosa.
Live-for-ever	Sedum Telephinum.
Spurge	Euphorbia Esula.
Greenbrier	Smilax hispida.
Cinque-Foil	Potentilla.
False Flax	Camelina sativa.
St. John's Wort	Hypericum perforatum.
Fleabane	Erigeron Canadensis.
Red top	Agrostis vulgaris.
Mallow	Malva rotundifolia.
Vervain	Verbena.
Plaintain	Plantago major.
Mullen	Verbascum thapsus.
Sow-thistle	Sonchus oleraceus.
Tower mustard	Arabis perfoliata.
Bladder campion	Silene inflata.
Bind-weed	Convolvulus arvensis.
Penny-cress	Thlaspi arvense.
Wild tare	Vicia Cracca.
Yellow avens	Geum strictum.
Cypress spurge	Euphorbia cyparissias.
Ginseng	Aralia quinquefolia.
Cone-flower	Rudbeckia hirta.
Pepper grass	Lepidium campestre.
Hedge bindweed	Convolvulus sepium.
Yellow melilot	Melilotus officinalis.
Sow-thistle	Sonchus asper.
White melilot	Melilotus alba.
Indian pipe	Monotropa uniflora.
Grindelia	Grindelia squarrosa.
Strawberry bush	Euonymus Americanus obovatus.
Prickly poppy	Argemone.
Catnip	Nepta cataria.
Shepherd's purse	Capsella bursa-pastoris.
Ox-eye daisy	Chrysanthimum leucanthimum
Burdock	Arctium Lappa.
Norway Cinque-foil	Potentilla Norvegica.
Climbing fumitory	Adlumia chirrhosa.
Blue vervain	Verbena hastata.
Spurge	Euphorbia Helioscopia.
Western rye grass	Agropyrum tenerum.
Hair grass	Deschampsia cæspitosa
Wild oat grass	Danthonia spicata.
Chicory	Cichorium intybus.
Sow-thistle (perennial)	Sonchus arvensis.
Prickly lettuce	Lactuca Canadensis.
Ground cherry	Physalis Viscosa.
Spikenard	Aralia racemosa.
Horse ragweed	Ambrosia trifida.
Stone crop	Sedum acre.
Club moss	Lycopodium lucidulum.
Bladder campion	Silene inflata.
Medick	Medicago lupulina.
Sorrel	Oxalis acetosella.
Beech-drops	Epyshegus Virginiana.
Atriplex	Atriplex patula.
Solanum	Solanum rostratum.
Pepperwort	Lepidium Virginicum.
False flax	Camelina sativa.
Black bindweed	Polygonum convolvulus.
Chess	Bromus secalinus.
Spurrey	Spergula arvensis.
Poison hemlock	Conium maculatum.
Thorn apple	Datura stramonium.
Lamb's quarter	Chenopodium album.
Elecampane	Inula Helenium.
Evening primrose	Œnothera biennis.
St. Johnswort	Hypericum perforatum.
Trailing Arbutus	Epigæa repens.
Redroot	Lithospernum arvense.
Wood Betony	Pedicularis Canadensis.
Cursed crowfoot	Rarumculus sceleratus.
Bluebottle	Centaurea Cyanus.
Couch grass	Agropyrum repens.
Amaranth	Amarantus paniculatus.
Water Speedwell	Veronica Anagallis.

Answers to Correspondents.

The work in connection with answering enquiries regarding insects and plants increases each year, and shows that there is a growing desire among farmers to know something of animal and plant life, especially of those forms that are injurious, and that they recognize the Agricultural College as an important source of information such as they need.

A large number of weed seeds have been identified and many questions referring to spraying have been answered. Fifty-two species of insects and 98 of plants have also been identified, and information regarding their habits, etc., supplied to correspondents.

The following is a list of the different species of insects and plants that have been examined and reported upon during 1895; but this does not give the number of specimens sent, for in several cases the same species was received from different localities. In some cases, the same one was referred to by fifteen different correspondents. In reporting upon an attack of the Army Worm, near Petrolea in 1894, I remarked, "that the presence of a parasite, the Tachina Fly, which I noticed in many of the worms sent, indicated that they were doomed, and it is likely that this parasite will largely ward off an attack in '95."

In the autumn of this year, I wrote to the correspondent interested in the "Army Worm" and learned that he had not been troubled this year with the pest that had destroyed sixty tons of hay and 300 acres of oats for him in 1894.

During this year, no enquiries have been received referring to this insect, though in several places last year they appeared in large numbers.

Many specimens of a cutworm moth (*Hadena arctica*) were received. This moth seems to have been very common in many places.

Many questions were asked about the Russian thistle, and several specimens sent which were supposed to be the plant. But as yet I have not received a specimen of the true Russian thistle. Prickly lettuce was sent as a specimen of this weed, and also a variety of Solanum. A specimen of the Russian thistle grown for instructive purposes in our own bed, used to illustrate typical forms of plant life, attracted considerable attention while it was allowed to grow. It was, however, destroyed before maturing its seed.

The plants chicory and ginseng were referred to by a number of correspondents who were desirous to know something of their economic value. Among insects, an aphis affecting the turnips, blister beetles attacking potatoes and beans, the plum scale, and the Buffalo carpet beetle, the last a serious pest in the house, seemed to attract much notice.

The moth, *Hadena arctica*, also appeared to be very common throughout the Province. This is the first year that specimens of the carpet beetle, plum scale and blister beetle have been sent to me. The first seems to be spreading and will no doubt prove to be a very serious pest in the house among woollen goods and carpets.

Descriptions of these three species are given, so that readers may be prepared to identify them and use remedies against their distribution. Any specimens of plants or insects sent to the College for identification or information concerning them will receive prompt attention.

Blister Beetles.

During this season many specimens of the common blister beetles have been received, especially those belonging to the genus *Epicauta*. The black variety, *Epicauta Pennsylvanica*, appears to have been very plentiful in various parts of the Province; many were reported feeding upon the leaves of mangels. Some specimens of the ash-colored variety, *E. cinerea*, were found feeding upon beans. This latter variety sometimes is quite destructive to potatoes as well as to beans. It owes its color to the presence of minute ash-gray scales or short hairs which can be readily rubbed off and then the beetles assume a black color. Blister beetles usually feed in crowds, and readily fly when disturbed. They lay their eggs in the soil; these hatch and the young grubs work about in search of the eggs of grasshoppers, upon which they feed. In a short time the perfect stage is reached and the mature insects then feed on a variety of plants In this insect we have a case where, at one stage of its development, it is beneficial, and at a later stage becomes injurious. Thus it is doubtful in some cases whether it is wise to destroy blister beetles, especially where grasshoppers are a nuisance. However, when their numbers are such as to be troublesome it may become necessary to destroy them.

Remedies.—1. The application of Paris green, where it can be done safely, is likely to destroy any feeding upon the foliage of plants.

2. Where practicable, drive the beetles upon heaps of straw, etc., and, when many have collected upon them, set fire to the heaps.

3. Hand-picking may be resorted to in some cases and may prove fairly successful.

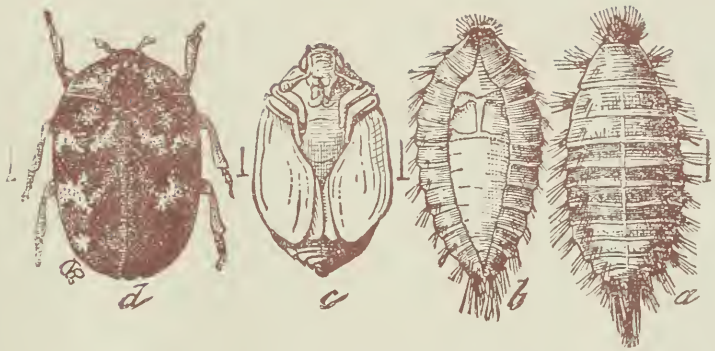
The Plum Scale. (*Lecanium*).

This is also a comparatively new insect to our Province and may prove injurious if not kept in check.

It is readily identified as an oval brown scale, about the fifth of an inch in diameter when fully developed. The small scales move early in April and make their way to the under side of the limbs. Here they remain and mature. About the end of May they begin to lay eggs under the scale.

EXPERIMENT IN THE EVAPORATION OF WATER FROM PLANTS.

1. Pot without Plant. 2. Mustard Plant. 3. Pigweed Plant.



The Buffalo Carpet Beetle. *Anthrenus scrophulariæ*. Linn.
a, larva; *b*, skin of a larva; *c*, pupa; *d*, beetle. All much enlarged. (After Riley.)

The young insects appear about the first of July, proceed to the leaves, and locate themselves on the under side, where they feed by sucking the juice. From this they emigrate in September to the branches and hibernate, as small scales, less than the size of a pinhead.

Kerosene emulsion applied as follows is recommended as a successful remedy:

1. Beginning of July, the emulsion diluted with six to eight parts water.
2. October, emulsion stronger, four parts water.
3. Same strength as No. 2, some time during the winter.
4. Again in the beginning of April, apply the same strength of emulsion.

Mr. Slingerland, of Cornell University, has made this insect a special study, and recommends that infested trees be sprayed thoroughly several times, twice at least in winter or before April.

If the insects can be attacked while moving, thorough spraying will be rewarded with success. Hence the necessity for observing closely for these periods in the life-history of the insects.

The Buffalo Carpet Beetle. (*Anthrenus scrophulariæ.*)

This is a European insect, which is reported as having been imported into the United States about 1874. During the present year specimens have been received from several parts of Ontario, showing that it is being well distributed here. It is comparatively harmless in Europe.

The adult insect is a small beetle, about three-sixteenths of an inch long. It is covered with very small scales, which give it a somewhat mottled appearance. There is an irregular red stripe down the middle of the back. The antennæ are composed of eleven joints, the last three being much larger than the rest. Like the potato beetle, it feigns death when disturbed. This beetle lives upon flowering plants and is frequently found on the spiræa, yarrow and some other plants of the compositæ. It lays its eggs on woollen material; these hatch and produce the larvæ, which become very serious household pests.

The larvæ are found feeding upon the woollen substance in the cracks of the floor, below carpets, and also in the carpet itself. The larvæ is about a quarter of an inch in length and is covered with coarse brown hairs, arranged in tufts on the head, and along the sides and end of the body. In autumn, the larva changes into the pupa and passes the winter in that stage, and the beetle emerges in spring.

Remedies.—1. Where carpets are infected, they should be taken up, well beaten and sprayed outside with benzine. If exposed for a few hours the smell of the benzine will pass off. The floors from which the carpets have been removed should be well washed with hot water.

2. Sometimes damping the carpet on the floor and running a hot iron over it at points infested, will prove very beneficial.

3. Corrosive sublimate (60 grains dissolved in a pint of alcohol) brushed over the floor at the edges, before the carpet is laid, and on the underside of the carpet, is a good remedy; but it must be remembered that this is very poisonous, and that it is not safe for children to play on a carpet thus treated.

4. In the case of clothing, blankets, etc., the application of benzine may be followed, but in all cases where it is used, remember that it is very inflammable and that no lights should be near during it use.

Both benzine and corrosive sublimate kill this insect readily, but as the one is very inflammable and the other poisonous, great care must be exercised in their use.

The appointment of Mr. Harrison to the position of Bacteriologist has deprived me of able assistance. His fondness for microscopic work and skill in drawing objects seen, fit him in an especial manner for his new position, and I have no doubt that he will prove himself suited for the patient and accurate work required in bacteriological research. It is hoped you will be able to continue the assistance in the department of biology, for, as you are well aware, the practical work has largely increased within the last year.

Mr. Clarke, of the third year, rendered me, during the summer, valuable help by the careful manner in which he conducted experiments upon the transpiration of plants.

Your obedient servant,

J. HOYES PANTON,
Professor of Biology and Geology.

Ontario Agricultural College,
December 31st, 1895.

PART IV.

REPORT OF

THE PROFESSOR OF CHEMISTRY.

To the President of the Ontario Agricultural College :

SIR,—It affords me pleasure to submit to you my annual report of the Chemical Department for the year 1895.

Towards the close of the year, a request from several sources came, through the Minister of Agriculture, asking the Chemical Department to analyze a large number of samples of sugar beets grown in Ontario, in the neighborhood of the following places : St. Catharines, Hamilton, London, Leamington and Amherstburg. My report contains the analyses of these sample, and of several other varieties of sugar beets grown in the Experimental Department of this institution under exactly similar conditions.

The additional grant of $300 to engage more assistance in the analytical room during the months of May to October inclusive, enabled us to enter upon extensive investigations, along with the Dairy Department, regarding the composition of dairy products, particularly in reference to the cheese-producing power of milk of varying percentages of fat. Our investigations of the latter have been very extensive; and we consider our results conclusive.

These tests began on the 1st of May and were continued without interruption until the end of October. They were conducted along the same lines as those of 1894, and are, in fact, a continuation of the work begun last year. During this period of six months, 147 vats of milk, 147 samples of whey, and 135 cheeses from the home dairy were analysed. Each sample having been analysed in duplicate, 429 complete analyses of the above products were made.

Samples of some sixteen vats of milk, and of cheese made therefrom, in the Marden factory, and of twenty-four vats of milk, and the cheese therefrom, in the Rockwood factory were also analysed, making a total of 589 complete analyses.

The extent of these investigations, covering as it does in every detail, actual factory conditions existing in Ontario, warrants, we think, the final conclusions which we have drawn therefrom.

ANALYSES OF 147 SAMPLES FROM OUR OWN DAIRY.

Milk.	Moisture.	Solids.	Fats.	Casein.	Albumen.
Average of lot L (or medium milk).....	88.071	11.929	3.215	2.371	.764
" " H (or rich milk).....	86.978	13.022	4.093	2.537	.803
" of lots L and H	87.524	12.476	3.654	2.454	.783

The averages in the above table are determined, in lot L, from complete duplicate analyses of samples from seventy-four different vats of milk, and, in lot H, from complete duplicate analyses of samples from seventy-three different vats of milk. All incomplete duplicate analyses, as well as complete duplicate analyses disagreeing with each other, were rejected in making up the averages. There is, practically, a difference of about nine-tenths of one per cent. between the average percentage of fats in lot L and that in lot H. Similar, and even greater differences occur in the percentages of fat in the milk sent by different patrons to cheese factories. But between the average percentage of casein (curd) in lot L and that in lot H, there is a difference of only .16. The difference in the average percentages of fat is more than five times greater than the difference in the average percentages of casein between lot L, which is called medium milk, and lot H, which is called rick milk.

Monthly average percentages of fat and casein in milk, showing ratio of fat to casein.

Months.	Lot L.			Lot H.		
	Fat.	Casein.	Lbs. casein to 1 lb. of fat.	Fat.	Casein.	Lbs. casein to 1 lb. of fat.
May	3.291	3.222	0.68	4.155	2.385	0.57
June	3.203	2.326	0.73	3.963	2.459	0.62
July	3.091	2.415	0.78	3.874	2.467	0.64
August	3.050	2.359	0.77	4.036	2.489	0.62
September	3.244	2.454	0.76	4.248	2.701	0.64
October	3.410	2.451	0.72	4.285	2.724	0.64
Average of all months	3.215	2.271	0.74	4.093	2.537	0.62

In the above table, are given, for each month, in both medium and rich milk, the average percentages of fats and casein, and the quantity of casein per pound of fat. These figures, for each month, are averages of from twelve to thirteen distinct samples from the same number of vats taken on different days. A comparison of the quantity of casein per pound of fat in lot L, or medium milk, of any month, with the quantity of casein per pound of fat in lot H, or rich milk, for the same month, shows more casein per pound of fat in poor or medium than in rich milk. The difference in any month is very close to the average difference for all months, which is 0.12 of a pound. The quantity of casein per pound of fat is unquestionably less in a rich than in a medium or poor milk. This difference has, as will be shown in following tables, an important influence on the quantity of cheese per pound of fat obtained from poor, medium, and rich milk.

Table showing quantity of casein per lb of fat in groups of vats varying within fixed percentages of fat.

Milk between	Fat.		Casein.		Quantity of casein.		No. of vats.
	Average %.	Increase of	Average %.	Increase or decrease of + or −.	Per lb. of fat.	Difference.	
2.5 and 3 % fat	2.926		2.388		0.82		16
3 " 3.5 "	3.280	0.354	2.334	−.054	0.72	−0.10	50
3.5 " 4 "	3.762	0.482	2.499	+.165	0.66	−0.06	33
4 " 4.5 "	4.207	0.445	2.530	+.031	0.60	−0.06	44
4.5 " 5 "	4.555	0.348	2.589	+.059	0.57	−0.03	4

Sixteen of the 147 vats of milk from our own dairy, lot L and lot H together, tested between 2.5 and three per cent. fat; fifty between three and 3 5 ; thirty-three between 3.5 and four ; forty-four between four and 4.5, and four between 4.5 and five. Each successive group increases in fat by between .348 and .482%; but with these increases in fat there is a continuous decrease in the quantity of casein per pound of fat. Now this fact, together with the occurrence, in most groups of the above table, of slightly higher percentages of casein as the groups increase in fat, appears to me to demonstrate beyond all question, that increases in percentages of fat are not accompanied by proportional increases in percentages of casein in milk; but that the increases in percentages of casein are proportionally less than the increases in percentages of fat.

Table comparing actual and calculated yields of cured cheese on a fat basis.

Month.	Lot L.					Lot H.				
	Fat, per cent.	Lb. of cured cheese per lb. of fat.	Actual yield of cheese.	Calculated yield of cheese.	Difference between actual and calculated.	Fat, per cent.	Lb. of cured cheese per lb. of fat.	Actual yield of cheese.	Calculated yield of cheese.	Difference between actual and calculated.
May	3.291	2.713	491.75	384.92	−16.83	4.155	2.497	436.75	453.55	+16.80
June	3.203	2.776	319.00	303.92	−15.08	3.963	2.548	361.00	376.05	+15.05
July	3.091	2.870	340.75	318.65	−22.10	3.874	2.525	409.50	431.50	+22.00
August.....	3.050	2.843	311.25	287.50	−23.75	4.036	2.455	359.00	382.76	+23.76
September	3.244	2.755	241.25	225.88	−15.37	4.248	2.445	280.75	296.05	+15.30
October	3.410	2.747	369.00	352.33	−16.67	4.235	2.515	387.75	404.44	+16.69

The figures in the table above are the averages of each month's tests of from nine to fourteen vats of medium and of rich milk. Without one exception there is less cheese per pound of fat from the rich than from the medium milk. The differences are as follows: May, .216 pound ; June, .228 pound ; July, .345 pound ; August, .388 pound ; September, .310 pound, and October, .232 pound. The average is practically three-tenths of one pound of cheese less per pound of fat from the rich than from the medium milk. The figures under actual yield of cheese represent the pounds of cheese made each month from the medium and from the rich milk, each lot of milk being kept by itself. The figures under calculated yield of cheese represent the pounds of cheese that would be credited to lot L and lot H respectively, assuming that the medium and the rich milk were mixed, and the division of cheese made upon the fat basis. For example, in the month of May, the medium milk, amounting to 4,500 pounds, and averaging 3.291 per cent., furnished 148.11 pounds of fat ; and the rich milk, amounting to 4,200 pounds, and averaging 4.155 per cent., furnished 174.51 pounds of fat. Now, 838.46 pounds of cheese, the yield of the mixed milk, divided by 322.62 (148.11 + 174.51), the total fat equals 2.599, the average yield of cheese per pound of fat. But 2.599 × 148 11 equals 384.92, the calculated yield of cheese from the medium milk ; and 2.599 × 174.51 equals 453.55, the calculated yield of cheese from the rich milk. These calculated yields credit the medium milk with 16.8 pounds of cheese less than the milk actually makes, and credits the rich milk with 16.8 pounds of cheese more than the rich milk actually makes. For each month, as the table shows, the calculated yield, in the medium milk, is less than the actual yield, and, in the rich milk, is more than the actual yield. For the entire season, the calculated yield of cheese from the 22,194.5 pounds of medium milk is 109 pounds less than the actual yield ; and the calculated yield from the 21,894.5 pounds of rich milk is 109 pounds more than the actual yield. These differences between the actual and calculated yields of cheese follow from or are due to, the casein in milk not increasing in the same ratio as the fat.

Comparing yield of cured cheese per pound of fat in milk with yield per pound of fat and casein in milk.

Months.	Lot L.				Lot H.			
	Fat, per cent.	Casein, per cent.	Cured cheese per lb. of fat.	Cured cheese per lb. of fat and casein.	Fat, per cent.	Casein, per cent.	Cured cheese per lb. of fat.	Cured cheese per lb. of fat and casein.
May	3.291	2.222	2.713	1.619	4.155	2.385	2.497	1.592
June	3.203	2.326	2.776	1.615	3.963	2.459	2.548	1.564
July	3.091	2.415	2.870	1.598	3.874	2.467	2.525	1.534
August	3.050	2.359	2.840	1.598	4.036	2.489	2.455	1.522
September	3.244	2.454	2.755	1.568	4.248	2.701	2.445	1.495
October	4.410	2.451	2.747	1.614	4.285	2.724	25515	1.540

The figures under cured cheese per pound of fat in lot L and in lot H are obtained by dividing the pounds of fat of each lot into its respective yields of cheese. While the figures under cured cheese per pound of fat and casein are obtained by dividing the sum of the fat and the casein of each lot into its respective yields of cheese. The figures for each month are averages of twelve to thirteen distinct tests on different days. This comparison shows that while the medium milk yields nearly three-tenths of a pound more cheese per pound of fat than the rich milk, the medium milk yields only six-hundredths of a pound more cheese per pound of fat and casein than the rich milk. It will be shown in following tables that the quantity of casein in any weight of milk, of a known percentage of fat, may be calculated. The question then reduces itself into one of the relative value of cheese from medium and from rich milk. The fat and casein together never fail to determine, very nearly, the cheese-producing power of milk, whatever its percentage of fat.

Table showing that casein in milk of known percentage of fat may be calculated.

Milk between	Number of vats.	Average fat, per cent.	Average casein, per cent.	Actual casein.	Calculated casein.	Difference.	Addends.
2.5 and 3 per cent. fat ...	16	2.926	2.388	114.560	105.502	-9.031	2.2
3 " 3.5 "	50	3.280	2.334	350.169	345.000	-5.169	2.3
3.5 " 4 "	33	3.762	2.499	247.288	237.468	-9.820	2.4
4 " 4.5 "	44	4.207	2.530	333.963	329.950	-4.013	2.5
4.5 " 5 "	4	4.555	2.589	31.068	31.200	+ .132	2.6

From lot L or lot H, 16 vats contained below 3 per cent. fat; 50 vats, 3 per cent. cent. and below 3.5 per cent.; 33 vats, 3.5 per cent. and below 4 per cent.; 44 vats, 4 per

and below 4.5 per cent., and 4 vats, 4.5 per cent. and below 5 per cent. This grouping of the vats is to compare the quantity of actual casein in milk with the quantity of calculated casein in milk. It has been shown in tables already given that there is a very close relation between the sum of the fat and casein in milk and the cheese-producing of milk. Fat in milk can be easily and accurately determined by the Babcock tester, as readily in a cheese factory as in a chemical laboratory. Casein cannot be actually determined in milk in factories. But casein in milk being fairly constant, increasing only slowly or slightly as fat increases, not increasing proportionately with fat, its amount in any quantity of milk of a known percentage of fat can be calculated. The addends given in the last column, which are used in calculating casein, represents average percentages of casein slightly modified, making the calculation simple and somewhat in favor of the richer milk. In making casein calculation, use 2.3 as the average percentage.

Comparison of calculated yield of cured cheese on a fat and casein basis, with actual yield in medium and rich milk:

Month.	Lot L.					Lot H.				
	Fat, per cent.	Average casein, per cent.	Actual yield of cheese.	Calculated yield of cheese.	Difference.	Fat, per cent.	Average casein, per cent.	Actual yield of cheese.	Calculated yield of cheese.	Difference.
May	3.291	2.4	401.75	400.802	.95	4.155	2.5	436.75	437.437	.68
June	3.203	2.4	319.00	318.416	.59	3.963	2.4	361.00	361.622	.62
July	3.091	2.4	340.75	336.024	4.73	3.874	2.4	409.50	414.210	4.71
August	3.050	2.4	311.25	304.139	7.12	4.036	2.5	359.00	366.117	7.11
September	3.244	2.4	241.25	237.711	3.54	4.248	2.5	280.75	284.381	3.63
October	3.410	2.4	369.00	365.282	3.72	4.285	2.5	387.75	391.346	3.59

Certain addends, as explained in the previous table, can be used in calculating casein in milk. The addends used depend, as was explained, on the percentages of fat in the milk. This ready and accurate means of calculating casein in milk makes a method, considering casein as well as fat, practicable for calculating the cheese-producing value of milk. To illustrate, take the division of the total make of cheese in May, assuming L, or medium, and H, or rich milk, to be two patrons. L, or medium milk, amounting to 4,500 pounds and averaging 3.291 per cent. fat, contained 148.11 pounds of fat by actual determination, and 103.5 pounds casein by calculation, using the addend 2.3, as the percentage of fat is above 3 and under 3.5. H, or rich milk, amounting to 4,200 pounds, and averaging 4.155 per cent. fat, contained 174.51 pounds of fat by actual determination, and 105 pounds casein by calculation, using the addend 2.5, as the percentage of fat is above 4 and under 4.5.

838.46 pounds, the total yield of cheese in May, divided by 535.62 (= 148.11 + 103.5 + 174.51 + 105), equals 1.5787, the average yield of cheese per pound of fat and casein.

But 1.5787×251.61 (= 148.11 + 103.5), equals 397.207, the calculated yield of cheese from L, or medium milk; and 1.5787×279.51 (174.51 + 105), equals 441.267, the calculated yield of cheese from H, or rich milk. Similarly, the calculated yields for each month from medium and rich milk, assuming them to be mixed, are made. The figures under differences in the above table show how much these calculated yields of cheese differ from the actual yields. They also show that the difference in every instance is favorable to the rich milk.

—	May.		June.		July.		August.		September.		October.	
	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.
1. By fat and casein method, using addend 2.4:												
Lb. of milk	4500	4200	3594.5	3594.5	3900	4200	3600	3600	2700	2700	3900	3600
Percentage of fat	3.291	4.155	3.203	3.963	3.091	3.874	3.050	4.036	3.244	4.248	2.451	4.285
Lb. of fat in milk	148.10	174.51	115.13	142.46	120.02	162 52	109.81	146.20	87.57	114.79	134.27	154.13
Lb. of casein in milk	100 00	100.12	83.60	88.40	94.10	102.33	84.89	89.67	66.24	72.91	95.75	98.61
Lb. of calculated casein	108.00	100.80	86.26	86.27	93.60	100.80	86.40	86.40	64.80	64.80	93.60	86.40
Ratio of F. and C. to C. cheese	1.568	1 586	1.583	1.578	1.595	1 555	1.586	1 543	1.583	1.563	1.619	1.612
Actual cured cheese	401.75	436.75	319.00	361.00	340.75	409.50	311.25	359.00	241.25	280.75	369.00	387.75
Calculated cured cheese	404.08	434.39	318.40	361.60	336.02	414.20	306.70	363.56	239.60	282.40	368.13	388.52
Difference	+2.33	−2.37	−.60	+.60	−4.73	+4.70	−4.55	+4.56	−1.65	+1 65	−.87	+.83
2. By fat and casein method, using addends 2, 2, 2.3, 2.4, 2.5, etc.:												
Lb. of fat in milk	148.10	174.51	115.13	142.46	120.02	162.52	109.81	146.20	87.57	114.79	134.27	154.13
Lb. of casein in milk	103.5	105.0	82.67	86.26	89.70	100.8	82.80	90.00	62.10	67.50	89.70	90.60
Ratio of F. and C. to C. cheese	1.596	1.562	1.612	1.578	1.625	1.514	1.616	1.519	1.611	1.540	1.647	1 588
Actual cured cheese	401.75	436.75	319.00	361.00	340.75	409.50	311.25	359.00	241.25	280.75	369.00	387.75
Calculated cured cheese	397.21	441.27	315.34	364.64	329.80	420.43	301.70	368 57	235.43	286.56	360.89	395.85
Difference	−4.54	+4.52	−3.66	3.64	−10.96	+10.93	−9.56	+9.57	−5.82	+5.81	−8.11	+8.10
3. By fat method:												
Lb. of fat in milk	148.10	174.51	115.13	142.46	120.02	162.52	109.81	146.20	87.57	114.79	134.27	154.13
Ratio of fat to C. cheese	2.713	2.497	2.776	2.548	2.870	2.525	2.843	2.455	2.755	2.445	2.747	2.515
Actual cured cheese	401.75	436.75	319 00	361 00	340.75	409.50	311.25	359.00	241.25	280.75	369.00	387.75
Calculated cured cheese	384.99	453.55	303.92	376.05	318.65	431.50	287.50	382.76	225.88	296.05	352 33	404.44
Difference	−16.88	+16.80	−15.00	+15 00	−22 00	+22.00	−23.7	+23.70	−15.30	15.30	−16.66	+16.60
4. By Fat + 2 method:												
Lb. of fat in milk	148.10	174.51	115.13	142.46	120.02	162.52	109.81	146.20	87.57	114.79	134.27	154.13
Fat with addend 2	238.10	258.51	187.02	214.35	198.02	246.52	181.81	218.20	141.57	168.79	212.27	226.13
Ratio of fat and 2 to C. cheese	1.687	1 689	1.700	1.684	1.719	1.661	1.712	1 645	1.704	1.663	1.738	1.714
Actual cured cheese	401.75	436.75	319.00	361.00	340.75	409 50	311.25	359.00	241.25	280.75	369 00	387.75
Calculated cured cheese	402.00	436.49	316 85	363.13	334 55	415.70	305.31	364.92	238.19	283.79	365.16	391 58
Difference	+.25	−.26	−2.15	+2.13	−6.20	+6 20	−5 94	+5.92	−3.06	+3.04	−3.84	+3.83

The above tabulated statement illustrates what the distribution of cheese between L and H, assuming these to be two patrons of a factory, would be according to each of three different methods which might be used. No. 1 in the table shows that by the use of an addend as 2.4, representing the average quantity of casein in milk, the cheese-producing power of the several lots of milk can be calculated within 1.3 per cent. of the actual yield on 336 pounds of cheese. This is the greatest difference between the actual and calculated yields in any month during the season. For the whole season the difference between the actual and calculated yields is only .06 of one pound in every one hundred pounds of cheese, which is less than one ounce. Method No. 2 uses addends, which, beginning with 2.2 and increasing .1 for each increase of .5 of one per cent. in fat, credits poor milk with a little less casein than such milk actually contains, and rich milk with a little more casein than it contains. The average increases in casein are a little less than .1 of one per cent. for increases in fat of half a per cent. These addends, therefore, credit rich milk with more cheese than its actual cheese-producing power in weight of cheese, which is equivalent to allowing something for the better quality of the cheese.

The monthly differences between the actual yields and calculated yields in L and H, or medium and rich milk, represent what they would be monthly to patrons with four to six cows, giving twenty-five pounds of milk per day.

Monthly average composition of cured cheese from medium and rich milk.

Months.	Cheese from medium milk.					Cheese from rich milk.				
	Moisture.	Solids.	Per cent. fat.	Per cent. casein.	Per cent. albumen.	Moisture.	Solids.	Per cent. fat.	Per cent. casein.	Per cent. albumen.
May	33.768	66.232	32.930	20.135	4.302	33.297	66.703	34.624	18.599	5.336
June	34.428	65.572	29.839	21.513	3.580	33.496	66.504	33.721	19.180	3.989
July	34.257	65.743	29.545	21.620	4.089	32.764	67.236	34.756	19.849	4.109
August	34.150	65.850	29.183	22.732	3.863	32.946	67.054	34.217	21.362	3.489
September	33.727	66.273	31.819	22.320	4.273	32.264	67.736	34.088	21.389	3.709
Average	34.066	65.934	30.663	21.664	4.021	32.953	67.047	34.281	20.076	4.125

This table, giving the monthly average composition of cured cheese made from medium and rich milk in the dairy tests, shows that the cheese made from the medium milk contains higher percentages of moisture and casein in each month than the cheese made from the rich milk; but lower percentages of fat occur each month in the cheese made from medium milk than in the cheese made from rich milk.

Monthly average composition of green cheese from medium and from rich milk.

Months.	Cheese from medium milk.					Cheese from rich milk.				
	Moisture.	Solids.	Per cent. fat.	Per cent. casein.	Per cent. albumen.	Moisture.	Solids.	Per cent. fat.	Per cent. casein.	Per cent. albumen.
May	36.568	63.432	32.741	22.500	1.212	35.669	64.331	35.225	20.924	.895
June	39.290	60.710	32.083	23.513	1.033	36.889	63.111	35.409	22.161	.639
July	39.213	60.787	31.295	25.248	.297	36.499	63 501	35.547	23.092	.516
August	37.515	62.485	31.480	24.736	.092	34.549	65.451	35.356	21.943	.614
September	35.776	64.224	32.431	24.792	.417	33.414	66.586	36.532	23.433	1.506
Average	37.672	62.328	32.006	24.158	.612	35.404	64.596	35.614	22.311	.834

Here is given the percentage composition of the cheese of the former table before curing. In cheese from the medium milk the percentages of moisture and casein are higher every month than in cheese from the richer milk. But the cheese from the richer milk contains. every month, a higher percentage of fat than the cheese from the medium milk. The difference between the percentages of fat in L and H cheese when green is practically the same as the differences when cured. The average difference in green cheese is 3.618, and in cured cheese, 3.608.

Absolute weights of the constituents in green and cured cheese each month from medium milk.

Months.	Moisture.		Total solids.		Fat.		Casein.		Cheese.	
	Green.	Cured.	Green.	Cured.	Green.	Cured.	Green.	Cured.	Green.	Cured.
May	155.41	133.66	269.59	266.09	139.15	132.30	95.62	80.89	425.00	401.75
June	133.39	109.83	206.11	209.17	108.92	95.19	79.83	68.63	339.50	319.00
July	141.07	116.73	218.68	224.03	112.58	100.67	90.83	73.67	359.75	340.75
August	122.96	106.29	204.79	204.96	103.18	90.83	81.07	70.75	327.75	311.25
September	91.41	81.36	164.09	159.90	82.86	76.76	63.34	53.85	255.50	241.25

The study of the table above, which gives the absolute weights for each month of each of the several constituents in green and cured cheese, shows that the percentage loss in curing is as follows : Of moisture, 14.9 ; of fat, 9.3 ; of casein, 15.3. These percentages are in terms of the absolute amounts in the green cheese. The cheese lost in curing is 5.4 per cent of its green weight.

Absolute weight of the constituents in green and cured cheese for each month from rich milk.

Months.	Moisture.		Total solids.		Fat.		Casein.		Cheese.	
	Green.	Cured.	Green.	Cured.	Green.	Cured.	Green.	Cured.	Green.	Cured
May	164.34	145.42	296.41	291.33	162.30	151.22	96.41	81.23	460.75	436.75
June	140.55	120.92	240.45	240.08	134.91	121.73	84.43	69.24	381.00	361.00
July	156.94	134.17	273.05	275.33	152.85	142.33	99.30	81.28	430.00	409.50
August	130.34	118.28	246.91	240.72	133.38	122.84	82.78	76.69	377.25	359.00
September	98.40	90.58	196.10	190.17	107.59	95.70	69.01	60.05	294.50	280.75

This table, corresponding with the former, gives similar data for cheese from rich milk. In the cheese from this milk we find the percentage loss of moisture in curing was 11.7 ; of fat, 8.2 ; of casein, 14.6. It loses in curing 4.9 per cent. of its green weight.

In the process of curing, cheese from the medium milk loses higher percentages of moisture, fat and casein than cheese from the rich milk.

Monthly average composition of whey from medium and rich milk.

Months.	Whey from medium milk.					Whey from rich milk.				
	Moisture.	Solids.	Per cent. fat.	Per cent. casein.	Per cent. albumen.	Moisture.	Solids.	Per cent. fat.	Per cent. casein.	Per cent. albumen.
May	93.303	6.696	.221	.120	.706	92.988	7.012	.332	.103	.822
June	93.301	6.699	.193	.115	.778	93.221	6.780	.237	.149	.830
July	93.380	6.620	.187	.098	.842	93.360	6.640	.261	.093	.881
August	93.489	6.511	.190	.119	.825	93.382	6.618	.273	.136	.859
September	93.460	6.540	.194	.118	.921	93.193	6.807	.295	.157	.915
October	93.253	6.747	.232	.117	.825	93.019	6.981	.283	.137	.862
Average	93.364	6.636	.203	.114	.816	93.194	6.806	.230	.129	.862

The above table gives the percentage composition of sweet whey from medium and rich milk in our Dairy tests. The whey from rich milk contains each month a higher percentage of fat than the whey from medium milk. The difference in casein is very little. Of the total fat, 5.817 per cent. goes off in the whey from the medium milk, and 6.244 per cent. in that from rich milk. Of the total casein, 4.452 per cent. is found in the whey from the medium milk, and 4.662 per cent. in that from the rich milk.

Conclusions.

1. A given weight of rich milk makes more cheese than an equal weight of medium or of poor milk.

2. The casein per pound of fat is greater in medium than in rich milk.

3. The percentage of casein is higher in rich milk than in poor or in medium milk in averages of several samples; but, in single samples, a decrease in casein may accompany an increase in fat, and *vice versa*.

4. Casein in milk does not increase in the same ratio as the fat, in poor, medium or rich milk.

5. A medium milk yields a greater weight of cheese per pound of fat contained in it than a rich milk.

6. There is a little more fat lost in whey from a rich milk than from a medium milk.

7. Cheese in curing 30 days loses from 4 to 5.5 per cent. of its green weight.

8. Cheese from medium milk loses, in curing, a slightly higher percentage of its green weight than cheese from rich milk.

MARDEN AND ROCKWOOD TESTS.

Once each week, during the whole season while the factories were in operation, samples of milk and green cheese were taken from Marden and Rockwood cheese factories

for chemical analysis. The object in taking these samples was that our investigations should be made to cover factory conditions in every detail. The results obtained in these tests confirm every conclusion reached in the tests made with the milk from our own dairy.

Monthly average percentages of fat and casein in milk of Marden and Rockwood Factories.

Months.	Marden factory.				Rockwood factory.			
	Per cent. fat.	Per cent. casein.	Lb. casein per lb. of fat.	Number of vats.	Per cent. fat.	Per cent. casein.	Lb. casein per lb. of fat.	Number of vats.
May	3.214	2.180	.678	4	3.311	2.191	.661	3
June	2.983	2.352	.788	4	3.021	2.372	.785	3
July	3.213	2.306	.717	3	3.297	2.351	.733	4
August	3.476	2.272	.653	4	3.558	2.329	.655	5
September					3.604	2.522	.700	2
October					3 900	2.715	.696	5
Average	3.221	2.277	.707	15	3 274	2.310	.708	22

The above table gives the monthly averages of fat and casein in the milk of the neighboring cheese factories of Marden and Rockwood. These averages, each month, are made up from duplicate analyses of several vats. The quantities of milk in most of the vats were in the neighborhood of 4,000 pounds. Here then are actual factory conditions as existing in Ontario. Though the percentages of fat do not vary widely, there is considerable irregularity in the quantities of casein per pound of fat in the different months.

Table showing quantity of casein per pound of fat in the average of all analyses of each group of vats varying within fixed percentages of fat.

Milk between—	Number of vats.	Fat.		Casein.		Lb. casein per lb. of fat.
		Average per cent.	Increase of.	Average per cent.	Increase or decrease of.	
2.5 and 3 per cent. fat	3	2.836		2 281		.804
3 " 3.5 " "	22	3.282	.446	2 273	−.007	.700
3.5 " 4 " "	9	3.635	.353	2 494	+.221	.607
4 " 4.5 " "	3	4.065	.430	2.732	+.238	.681

In this table, the vats of Marden and Rockwood factories are grouped within fixed percentages of fat, to obtain greater differences in fat percentages, in order to study the relation of fat to casein. Each succeeding group is richer in fat than the preceding one by nearly half of one per cent. With these increases in fat, the casein per pound of fat decreases regularly by one-tenth of one pound, except in the last group. The slight increase in the last group, as the study of other tables will show, appears to be characteristic of September and October milk, in which months this higher percentage of fat occurred. Here, as in our dairy tests, there is an evident decrease of casein per pound of fat as milk increases in richness.

Table showing yield of green cheese per pound of fat in the two cheese factories.

Factory.	Per cent. of fat.	Lb. cheese per lb. of fat in milk.	Factory.	Per cent. of fat.	Lb. cheese per lb. of fat in milk.
Marden	2.985	3.171	Rockwood	3.006	3.063
"	3.199	2.921	"	3.398	3.012
"	3.235	2.835	"	3.458	2.826
"	3.485	2.642	"	3.546	2.789
			"	3.599	2.827
			"	3.903	2.789

From the analyses of the several vats of milk of each month, the average percentages of fat and casein in the milk are calculated Since the different vats did not contain equal qualities of milk, these monthly averages are not just the same as the monthly averages of the analyses. The same is true for the casein. In the above table, the monthly averages are arranged in the order of increasing percentages of fat. In Marden milk, there are regular decreases in yield of cheese per pound of fat as the percentage of fat increases. The same general tendency shows itself in Rockwood milk, though here, in most instances, there are very slight increases in fat.

Distribution of cheese according to five different methods.

Lb. of milk.	Average per cent. of fat.	Actual yield.	Pooling.		Fat basis.		Fat + 2 basis.		Fat and casein basis.	
			Lb.	More or less + or −	Lb.	More or less + or −	Lb.	More or less + or −	Lb.	More or less + or −
16,642	2.841	1,595.5	1,620.27	+ 24.8	1,366.74	−228.8	1,461.17	−134.3	1,434.03	−161
86,043	3.269	8,164.75	8,377 15	+212.4	8,132 40	− 32.4	8,223.42	+ 58.7	8,190.85	+ 26
33,230	3.626	3,339.75	3,235.27	−104.5	3,483.53	+143.8	3,390.96	+ 51.2	3,422.91	+ 83
12,590	4.055	1,358.50	1,225.76	−132.7	1,475.81	+117.3	1,382.62	+ 24.1	1,410.70	+ 52

This table shows the quantity of green cheese made from the total milk in each group of vats of the Marden and Rockwood factories. By reference to previous tables giving results of samples from our own dairy, it will be seen that the grouping of the vats depends on the percentages of fat, each succeeding group being one-half of one per cent. richer in fat than the preceding one. The table above also shows what the distribution of the total make of cheese among the four groups, which may be considered patrons of one factory, would be, according to each of four different methods by which dividends in cheese factories may be distributed. By the pooling method, which considers only the weights of milk, each of the two poorer groups is credited with more than the milk actually makes, while each of the two richer groups is credited with less than the milk actually makes. Remembering that a 3.6 and 4 per cent. milk make a quality of cheese probably better than the quality of that from a 3.2, and most clearly superior to that from a 2.8 per cent. milk, remembering also that disregarding quality of milk is an inducement to the dishonesty disposed to water and skim milk, it is most apparent that the pooling method is bad and should not be practised in any factory. The fat basis of distribution is in the right direction. It considers the quality as well as the weight of milk. But by this method, since casein in milk does not vary as the fat, it makes a very great distinction in favor of the rich milk. Previous tables show that variations in percentages of fat

are proportionately greater than in casein. The fat basis of distribution, therefore, reverses the advantage, crediting the two poorer groups with much less than the milk actually makes, and the two richer groups with much more than the milk actually makes. This method gives the advantage to the richer milk, and discourages watering and skimming. For these and other reasons it is commendable. But owing to the facts (1) that the casein of milk, as well as the fat, enters into the cheese, influencing, like fat, its amount and its quality, and (2) that the variations in the percentages of the casein in milk are not in the same ratio as those in the percentages of fat, the fat basis of distribution gives too great an advantage to the richer milk. Two being somewhat in the neighborhood of the average percentage of casein, particularly in milk between 3 and 3.5 per cent. of fat, its addition to the fat reading considerably reduces the advantage given, by the fat basis alone, to the richer milk. But the fat + 2 method does not recognize any difference in the percentages of casein in poor, medium and rich milk. For this reason, as in our dairy tests for May, a poor milk may be credited with more cheese than the milk produces, and the rich milk with less cheese than it produces and *vice versa*. The fat and casein method, using addends to calculate casein, distributes the cheese, as in the dairy tests, fair to all qualities of milk, making due allowance for quality and quantity of cheese.

Comparison between the different methods of distribution of cheese from equal quantities of milk with different percentages of fat.

Lb. of milk.	Average per cent. of fat.	Actual yield.	Pooling.		Fat basis.		Fat + 2.		Fat and casein basis.	
			Lb.	More or less + or −	Lb.	More or less + or −	Lb.	More or les + or −	Lb.	More or less + or −
15,000	2.841	1,438.4	1,496 95	+ 58.6	1,233.5	−204.9	1,330.22	−108.2	1,301.56	−136.84
15,000	3.269	1,423.4	1,496 95	+ 73.6	1,419 34	− 4.1	1,447.83	+ 24.4	1,437.88	+ 14.48
15,000	3.626	1,507.5	1,496.95	− 10 6	1,574.34	+ 66.8	1,545 93	+ 38.4	1,555.88	+ 48.38
15,000	4.055	1,618.5	1,496.95	−121.6	1,760.52	+142.0	1,663.82	+ 45.3	1,692.46	+ 73.96

To make the figures of the preceding table more intelligible, they are calculated to equal weights of milk. Fifteen thousand pounds of milk would represent the quantity sent to a factory in one month by one patron, having twenty cows, giving a daily average of 25 pounds of milk. By the fat and casein method of distribution, the quantities of cheese, over actual yield, going to the 2nd, 3rd, and 4th patrons, are in fair proportion to quantities of fat in the respective lots of milk ; from which it will be seen that every conclusion drawn from the experiments made with samples from our dairy, is confirmed by the results obtained from Marden and Rockwood factories.

Single Tests of Yield of Cheese from Medium and Very Rich Milk.

After the conclusion of our more elaborate experiments, five single tests were made to see (1) the effect of setting at 80° and heating gradually to 100° on the quality of cheese made from very rich milk, and (2) if the conclusions drawn in our experiments with milk varying in fat would hold good for very wide differences in fat. Details of these tests will be reported by the dairy department.

Following is a table showing yields of cheese, etc., from each of the two extremes.

Yields of green cheese from single lots of milk containing wide differences in the percentages of fat, and the distribution of the cheese by four different methods.

Date of tests.		Lb. of milk.	Per cent. fat B. deter.	Actual yield of cheese.	Pooling.		Fat basis.		Fat + 2.		Fat and casein.	
					Lb. cheese.	Diff. from actual in 15,000 lb. milk.	Lb. cheese.	Diff. from actual in 15,000 lb. milk.	Lb. cheese.	Diff. from actual in 15,000 lb. milk.	Lb. cheese.	Diff. from actual in 15,000 lb. milk.
December 20	L	300	3.25	28.25	31.75	+175.00	25.798	—122.6	27.783	—23.35	27.319	— 46.5
	H	300	4.75	35 25	31.75	—175.00	37.705	+122.6	35.721	+23.35	36.179	+ 46.5
December 21	L	300	3.20	28.50	33.94	+272.00	24.965	—176.75	27.783	—35.85	27.0435	— 72.8
	H	300	5.50	39.375	33.94	—272.00	42.909	+176.75	40.072	+35.85	40.8111	+ 72.3
December 23	L	300	3.10	28.50	32.00	+175.00	26.449	—102.50	28.381	— 5.5	28.097	— 20
	H	300	4.4	35.50	32.00	—175.00	37.540	+102.50	35.61	+ 5.5	35.90	+ 20
December 28	L	300	3.00	26.50	31.875	+268.75	23 610	—144.5	26.34	— 8	25.789	— 35.4
	H	300	5.10	37.25	31 875	—268.75	40.138	+144.5	37.402	+ 8	37.954	+ 35.4
December 30	L	300	3.00	28.50	32.125	+181.25	24.093	—220.4	26.770	—86.5	26.187	—115.2
	H	300	5.00	35.75	32.125	—181.25	40.155	+220.4	37.478	+86.5	38.045	+115.2

In comparing the results in this table, it should be remembered that the figures represent single tests, and that the samples are from cows which have been milking for some time or are well advanced in their period of lactation. A comparison of the figures of this table with those representing averages in previous tables under the regular dairy tests reveals nothing conflicting with former conclusions.

Testing ratio of fat to casein in individual cow's milk through periods of several weeks

Belle Temple.

Date.		Total solids.	Fat, per cent.	Casein, per cent.	Quantity of casein per lb. of fat.	Lb. of milk.	
						Morning.	Evening.
August	2nd	15.540	6.277	2.854	.46	6	7
"	7th	14.946	5.928	2.831	.48	8	..
"	9th	13.956	5.650	2.835	.50	6	6
"	12th	14.906	5.842	2.903	.50	8	8
"	13th	15.317	5.989	3.025	.51	9	9
"	14th	15.139	5.897	3.157	.54	8	7
"	15th	15.185	6.031	3.100	.51	9	6
"	16th	14 330	5.139	3.007	.59	8	8
"	17th	15.682	6.589	2.975	.45	8	7
"	19th	15.938	6.288	3.053	.49	5	6
"	20th	15.576	6 187	3.222	.52	6	6
September	20th	15.189	5.853	3.128	.53	5	6
"	21st	15.631	6.189	3.116	.50	7	5
"	23rd	15.488	5.863	3.157	.58	5	5
"	24th	16.713	7.391	3.172	.43	7	5
"	30th	16.118	6.821	3.138	.46	4	6
October	12th	17.264	7.546	3.459	.46	4	4

Belle Temple, a Jersey cow, dropped her calf August 10th. 1894. We began testing her milk August 2nd, 1895. By taking averages of fat and casein percentages from August 2nd to August 15th, August 16th to August 20th, and September 20th to September 30th, there is. in each succeeding period, an increase in fat and in casein. Both increase again on October 12th. The amount of casein, .50, per pound of fat remains constant in the first three periods, but drops to .46 on October 12th.

Nora.

Date.	Total solids.	Fat. per cent.	Casein. per cent.	Quantity of casein per lb. fat.	Lb. of Milk.	
					Morning.	Evening.
August 23rd	10.689	3.004	2.123	.706	17	13
" 26th	11.948	2.900	2.385	.823	15	15
" 27th	11.161	2.762	2.407	.872	15	14
" 29th	11.907	3.612	2.475	.685	14	12
September 25th	10.002	2.293	2.122	.926	7	7
" 26th	11.008	3.274	2.163	.661	10	7
" 27th	11.514	3.025	2.407	.795	8	10
" 30th	11.249	2.548	2.441	.958	10	11
October 1st	11.103	2.840	2.387	.839	10	9
" 2nd	10.532	2.689	2.272	.845	8	11
" 30th	12.943	4.140	2.573	.621	8	7
" 31st	12.667	3.823	3.009	.787	9	7
November 1st	12.164	3.671	2.838	.773	9	7
" 2nd	12.728	3.644	2.607	.715	9	7
" 4th	11.100	4.250	2.464	.582	8	7
" 5th	12.962	3.685	2.456	.666	8	7
" 6th	12.815	3.900	2.372	.608	6	6
" 7th	12.357	3.896	2.759	.708	7	6

Nora is a Shorthorn grade cow, nine years old. She dropped her calf the first week in May, 1895. We began testing her milk on August 23rd. In the percentages of fat and casein there are many variations. The average percentage of fat from August 23rd to October 2nd is 2.923; but from October 30th to November 7th it is 3.876. The average percentage of casein for the latter period is practically .3 per cent. higher than for the former. The tendency appears to point distinctly to an increase in both fat and casein as the season advances; but the ratio of fat to casein in the first period being 1:.80, and in the latter being 1:.68, shows that the casein has not increased as the fat.

Patience.

Date.	Total solids.	Fat per cent.	Casein per cent.	Quantity of casein per lb. of fat.	Lbs. of milk.	
					Morning.	Evening.
October 3rd	13,672	4,023	2,750	.68	8	7
" 4th	14,067	6,039	2,263	.37	9	7
" 5th	14,725	6,223	2,728	.44	8	9
" 8th	15,223	5,770	2,425	.42	8	9
" 9th	16,297	7,647	3,115	.41	8	9
" 10th	16,095	6,543	3,139	.48	8	8
" 11th	13,841	4,874	2,719	.56	8	7
" 12th	13,654	5,298	2,894	.55	7	9
" 15th	14,450	4,698	3,328	.71	7	8
" 17th	13,415	4,608	3,194	.69	7	8
" 18th	14,193	5,655	2,972	.53	7	5
" 19th	13,620	4,959	2,975	.60	7	5
" 21st	14,971	5,646	3,047	.54	5	5
" 22nd	14,848	5,112	3,241	.63	6	5
" 23rd	13,530	4,416	3,369	.76	6	5
" 25th	13,453	4,380	3,093	.71	7	7
" 26th	13,783	5,127	3,372	.66	6	5
" 28th	14,671	5,371	3,124	.58	5	4
" 30th	13,487	4,640	3,178	.71	7	3

Patience, an Ayrshire cow, dropped her calf February 11th, 1895. Her milk was tested during the month of October. Taking averages of the fat and casein for the first half, 3rd till 15th, and for the second half of the month, it appears that, though the fat is less in the latter half than in the former half of the month, the casein averages about .3 of one per cent. more from the 17th to the 30th, than from the 3rd to the 15th. The casein, therefore, though accompanied by a decrease in fat, has increased with the advance in season.

Margaret.

Date.	Total solids.	Fat per cent.	Casein per cent.	Quantity of casein per lb of fat.	Lbs. of milk.	
					Morning.	Evening.
August 2nd	13,063	4,018	2,556	.64	11	10
" 7th	13,470	4,322	2,457	.57	8	9
" 12th	13,591	4,718	2,547	.54	10	6
" 13th	13,619	4,332	2,791	.64	10	6
" 14th	13,344	4,394	2,738	.62	6	7
" 15th	13,169	4,415	2,784	.63	10	6
" 16th	12,473	3,591	2,703	.75	..	9
" 17th	12,733	3,889	2,707	.70	9	8
" 19th	14,007	4,592	2,972	.65	9	8
" 20th	13,646	4,454	2,897	.65	8	8
" 21st	13,496	4,636	2,847	.61	7	7
" 24th	12,925	3,974	2,760	.70	9	7
" 27th	13,072	3,493	2,806	.80	8	8
" 28th	12,932	4,180	2,835	.68	7	8
" 29th	12,819	3,902	2,847	.73	7	8

The cow *Margaret* is a Holstein, eight years old. She dropped her calf on the 19th March, 1895. We began testing her milk on August 2nd, and continued testing it until October 2nd. The cow having aborted on October 3rd, and the September tests being unsatisfactory, only those made in August are reported. Dividing the time into three periods as follows: 2nd to 14th, 15th to 20th, and 21st to 29th, the fat decreases each succeeding period, while the casein increases.

In all these tests of individual cow's milk, whether fat increases or decreases, casein increases in the latter periods in each test. It is not easy to name, without further investigations, the exact causes of these slight variations in casein. Among the causes, no doubt, are the condition of animal, the season, and the period of lactation.

Sugar Beet Analysis.

	Grower.	Size of plot.	Kind of soil.	When manured.	Date of seeding.	Distance between rows.	Distance between plants.
						in.	in.
1	Elliott Kimball, Leamington		Clay loam		May 27.	24	
2	Peter Conover, "	30 rods	Sandy loam	Clover sod			12
3	" " "	"	"	"			12
4	Thos. Harris, "	1-10 acre	"	1895	May 18.	30	
5	" " "	1-10 "	"	"	" 18.	30	
6	Robt. Wilkinson, "	¼ "	Clay loam	1894	" 26.	20	5
7	Jas. M Wigle, "		Sandy loam		June 1.	30	10
8	Lionel Robinson, "	½ acre	Clay loam		May 10.	18	
9	Wm. Armstrong, "	¼ rod	"		June 1.	20	
10	Thos. Armstrong, Goldsmith, Essex Co.	10 rods	Sandy loam	1895	May 18.	24	8
11	Jas. Shanks, Leamington, Essex Co	10x15 ft.	Sandy	1894	" 15.	20	10
12	David Reid, Goldsmith	3 rods	Clay loam	1884	" 15.	42	8
13	A. Ellis, Leamington	½ acre	Sandy loam	1894	" 16.	24	
14	" " "	⅛ "	"	"	" 16.	24	
15	Andrew J. Noble, Leamington	¼ "	Black loam	"	" 22.	18	10
16	Industrial Home, Welland	¼ "	Clay loam	"	June 7.	30	9
17	" " "	¼ "	Yellow loam	"	" 7.	30	9
18	Jas. Walker, Beamsville	1-5 "	Sandy loam	"	May 22.	36	6
19	" "	1-5 "	"	"	" 22.	36	6
20	" "	1-5 "	"	"	" 22.	36	6
21	J. Edmonson, Owen Sound		Gravelly loam		" 15.	18	
22	T. D. Campbell, "		Clay loam	1895	" 15.	24	
23	Geo. Lockwood, "		Sandy loam	"	" 15.	24	
24	A. H. Pettit, Grimsby						
25	" " "						
26	" " "						
27	Lot 6, Con. 7, Mersea Tp., Essex Co						
28	" " " "						
	Experimental Farm, Guelph.						
29	Jersey	1-100 acre.	Clay loam	1895	May 1.	26.4	10
30	New Danish Improved	"	"	"	"	26.4	10
31	Austria Electoral Wohanka	"	"	"	"	26.4	10
32	French Yellow	"	"	"	"	26.4	10
33	Improved Imperial	"	"	"	"	26.4	10
34	Red Skinned	"	"	"	"	26.4	10
35	Red Top	"	"	"	"	26.4	10
36	Vilmorin's Improved White	"	"	"	"	26.4	10
37	Lane's Improved	"	"	"	"	26.4	10
38	French White	"	"	"	"	26.4	10
39	Kleinwanzelben	"	"	"	"	26.4	10
40	Champion	"	"	"	"	26.4	10
41	White Silisian	"	"	"	"	26.4	10

SUGAR BEET ANALYSIS —*Continued.*

Date of thinning.	Number of hoeings.	Average length of root.	Average of root above ground.	Average weight of root.	Estimated yield per acre.	Analysis of juice.			Remarks.
						Solids.	Sugar.	Purity.	
		in.	in.	lb. oz.					
.....	3	11.3	1.5	5 1	....	17.00	16.56	97.4	Three beets.
July	3	12.0	1.0	4 9	25 ton	14.20	13.50	95.1	Three beets.
"	3	6.1	.0	2 7	25 ton	16.10	15.12	93.9	Three beets.
.....	4	17.0	8.0	9 5	.....	14.65	13.95	95.2	One beet.
.....	4	11.6	3.1	3 14	.....	17.20	16.74	97.3	Three beets.
July	3	12.3	1.4	2 2	.....	14.00	12.42	88.7	Three beets.
.....	2	15.5	.0	4 12	25 ton	15.20	13.77	90.6	Four beets withered and soft.
.....	1	10.0	.5	5 0	25 ton	17.20	16.10	93.7	Two beets long and tapering.
July 3....	1	12.0	.5	3 9	.....	16.00	14.40	90.0	Two beets
June 6....	3	9.6	.0	3 4	.....	17.50	16.02	91.8	Three beets.
" 7....	3	9.3	.0	2 9	.. ..	14.65	12.60	86.0	Three beets, scabby.
" 10.. .	3	12.0	1.5	4 4	.....	16.80	15.12	90.0	Four beets, smooth and fine.
" 10....	3	18.0	.0	2 13	.....	14.30	13.14	91.9	One beet, smooth.
" 10....	3	13.5	2.5	6 13	.....	16.10	14.31	88.9	Two beets.
.....	1	14.5	2.0	6 2	.....	14.00	11.70	83.6	Two beets.
.....	....	12.9	1.6	5 10	24 ton	13.40	11.52	87.4	Six beets, very thick at crown.
.....	....	9 8	1.0	3 7	24 ton	15.45	13.50	87.4	Six beets, short, thick, numerous rootlets.
June 5....	3	19.0	9.0	10 2	25 ton	13.40	10.80	80.7	One beet, rough, rotten at centre.
" 5....	3	12.3	1.3	2 15	.... .	15.60	14.58	93.4	Three medium smooth beets.
" 5....	3	11.3	1.2	2 14	.....	15.10	14.00	92.7	Three beets, very smooth.
July	1	13.4	5.6	4 2	.....	13.30	11.16	83.9	Five smooth even beets.
"	3	..	....	3 8	.....	18.10	17.85	98.6	Four medium smooth and even beets.
"	5	14.3	6.8	6 1	... ..	11.15	8.60	77.2	Three beets, over half above ground.
.....	....	12.5	2.5	3 14	.....	15.80	14.96	94.6	On account of drouth came up very irregularly. Six roots divided into three lots of two each according to size and shape.
....	....	13.0	4.0	5 9	.....	15.00	12.45	83.0	
.....	....	15.5	4.5	6 1	.....	14.40	13.68	95.0	
.....	....	10.5	.0	5 8	.....	18.20	15.75	86.5	Two roots, short and rough.
.....	....	9.3	1.0	2 3	.. ..	15.45	13.32	86.2	Two beets.
When 3 in. high.	....	11.0	1.7	1 10	15.13	19.80	18.39	92.9	These thirteen varieties were grown by the Experimental Department under similar conditions. For further particulars regarding their growth and cultivation, see the report of the Experimentalist.
"	....	9.0	1.2	1 8	13.00	16.40	14.40	87.8	
"	....	9.5	.7	1 7	15.80	18.00	16.92	94.0	
"	....	9.2	.5	1 6	13.20	16.60	14.40	86.7	
"	....	8.5	.5	1 5	12.43	18.65	17.55	94.1	
"	....	10.5	1.5	1 10	12.35	14.80	12.60	85.1	
"	....	11.5	2.2	1 11	15.40	16.00	15.03	93.9	
"	....	10.0	1.0	1 12	14.00	17.60	16.20	92.0	
"	....	9.7	1.0	1 9	16.20	16.40	14.62	89.2	
"	....	8.5	1.5	1 15	11.08	16.60	14.94	90.0	
"	....	8.5	1.0	1 7	12.58	17.00	15.12	88.9	
"	....	10.0	1.0	1 4	11.15	17.90	16.74	93.5	
"	....	10.0	1.0	1 13	15.19	15.00	13.50	90.0	

The specimens received at Guelph for analysis were very irregular in shape and size. Some of the beets were very large. In these, the solids, sugar, and purity were low as a rule. In all instances, where the same samples contained both large and small beets, the juice of the smaller beets gave higher readings. But in a few instances, large beets of one sample gave higher reading than small beets of another. It is also noticeable that beets grown with large portions out of the ground give low readings.

Instructions to Growers of Sugar Beets.

These instructions were sent to growers at the time of the distribution of the seed.

Soil. No definite rule can be given in regard to soil from its chemical composition alone. Actual results must prove the best and most reliable test. In a general way, it may be said, that any soil which will give good crops of grain, fruit or potatoes will produce good sugar beets. Soils which have been under cultivation for a few years are better adapted to this crop than virgin soils containing large quantities of organic nitrogen. All soils should have good natural or artificial drainage, so that the beet roots shall not reach the water-line of the soil. Hard clay subsoils at a small depth are not suitable. The soil should have a tillable depth of from twelve to fifteen inches, should be well drained, mellow in texture, and easily kept porous. In the experiments made in Ontario, the best general results have been obtained from clay loam or sandy loam soils, although a few very fine returns have been derived from heavy clay, and occasionally from sandy soil.

Manures and Preparation of the Soil. The most approved system of cultivation is to have the sugar beets succeed a grain crop. If the soil was fairly enriched with manure for the preceding grain crop, no manure need be used for the beet crop. Otherwise, barnyard manure at the rate of fifteen loads per acre should be applied as soon as possible after harvest of the grain crop, and plowed in to a light depth, and towards winter this should be followed by deep plowing and subsoiling. As soon as the soil is fit to be worked in spring, it should be brought into as fine tilth as possible, and the seed at the rate of at least twelve pounds per acre should be sown as early as the proper temperature will permit, as there is less danger to the young plants from frost than there is from drouth. The seeding should follow as quickly as possible after the last cultivation of the ground, before the surface gets too dry. Barnyard manure should not be applied in spring, unless it has been thoroughly rotted ; fresh or only partially rotted manure may give a large yield in weight, but the roots will contain so much foreign matter as will largely reduce their value.

Seeding. The seed must be of approved varieties, specially adapted to the production of beets rich in sugar. It should be sown in drills not over 24 inches apart, and in very rich soils 18 inches is a still better distance. The seed needs a very light covering, not exceeding one inch. If part of the seeds are not covered at all, it will not cause so much damage as if they were covered too deeply. As soon as sowing is completed, the land should be rolled, because in thus pressing the surface the humidity is drawn by capillary attraction from the deeper soil. In the Province of Ontario, 12 pounds of seed per acre have been found to be ample, although in Europe fifteen to twenty pounds are generally used. It is recommended that the rollers used after sowing should have rings, because they make the land a little rough, and the soil after a heavy rain is not so liable to become crusted.

Subsequent Cultivation. Whenever the plants have grown so that the rows are visible, hoeing must be done, not only for the purpose of destroying the weeds, but because the plants require a loosened soil. The oftener the soil is hoed by hand or by the cultivator the better, both as to yield and quality of the crop. Care must be taken that no soil shall cover the leaves of the young plants.

Thinning Out. When the plants have three or four leaves they must be thinned out, so as to leave a space of from four to eight inches between each of the remaining plants in the row. The richer the soil, the smaller the space required for each plant. The thinning can be done partly by use of the hoe and partly by hand, as in the case of carrots. Care should be taken to preserve the strongest plants. It is not sufficient to cut off the leaves of the superfluous plants, as the leaves grow again. Much of the success of the crop depends on the care exercised in thinning out.

It is most desirable that farmers should carefully investigate the question of close cultivation, as there has been too general a disposition to keep the rows too far apart, and the distance between the plants too great, for the purpose of saving in labor, and with the expectation that as much money would be obtained from the crop of a smaller number of large beets as would be obtained from a crop of larger number of small beets. To test this, take a plot of one acre, ten rods wide and sixteen rods long, make the drills thirty inches apart, which would give you sixty-six rows of beets, and with beets twelve inches apart, would give 17,424 beets to the acre, which at two pounds weight per beet, would give 17.424 tons. On the other hand, making the drills twenty-four inches apart, you get eighty-two rows of beets, and with plants six inches apart, there are 528 beets in the row, or 43,296 plants per acre, which at one pound per root would give 21.648 tons per acre. Although some very large yields of good quality have been obtained from the wider cultivation, all authorities agree that the best results generally are derived from the close cultivation, especially as to the percentage of sugar, which is estimated as fully twenty per cent. greater under the latter method of cultivation. Irrespective of the claim for larger yield per acre, the higher price obtained per ton of roots will largely exceed the extra expense of labor incurred under close cultivation.

Further Cultivation. When hoeing or cultivating, which should be done as frequently as possible until the leaves become too large to permit of it, the soil must be kept hilled up, so that no part of the roots shall protrude above the ground; as any part of the beet exposed to the sun and light is not only deficient in sugar, but becomes impregnated with mineral salts, etc., and is thus rendered valueless for the factory.

Harvesting. When the leaves become yellowish green and fall off, leaving a kind of wreath around the plant, the roots are ripe, and should be taken up. There is quite a variety of implements used for extracting the roots from the soil, and cutting off the heads by which a large saving in labor is effected, some of which will be found necessary when beet cultivation is carried on extensively. The green heads are cut off, and the roots should be immediately covered with earth in small heaps, as they should not be allowed to lie and wilt after being harvested. If not intended to be transported to the factory or to be fed at once, they should be pitted in a manner such as used for potatoes, securing them from wet, freezing or heating.

Experiments in the Culture of the Sugar Beet in Nebraska.

The following extracts on the cultivation of sugar beets are taken from "Bulletin No. 16, Sugar Beet Series No. 16," and "Bulletin No. 36, Sugar Beet Series No. IV," of Nebraska.

Cultivation.

Soil, climate and cultivation are factors of equal importance in the culture of the sugar beet.

In respect to the first two, nature has here left but little to be desired. That the beet grower may be enabled to make the condition that is left wholly with him equal to the others in value; the following pages, giving the results of the best experience of European farmers, have been prepared by Mr. H. E. L. Horton of this station, who has had considerable experience in beet growing and with beet growers, both in this country and in Europe.

Preliminary.

Tillage gives a porous soil, which allows of circulation of air and moisture, two very important factors, and secures to the particles of plant food an equal distribution through the layer of soil worked.

On every hand we see the utmost care taken in preparing a homogeneous mellow seed-bed when a crop of importance is to be raised. Air must come to the seed and plant, else it will rot and die; moisture and warmth it must have, and then as it starts growing the soil must be mellow and present no obstacle to the rootlets.

The natural tendency of the root is to grow downward, and it does not bore its way, but pushes through the interstices between the earth particles. The beet has a arge root system, and when it is well developed it is a safeguard against drouth.

Who does not know that trees and plants tend to a symmetrical form in their growth, and how every obstacle interferes and distorts? This is equally true with roots.

Tillage comes in and reduces to a minimum the disturbing influences.

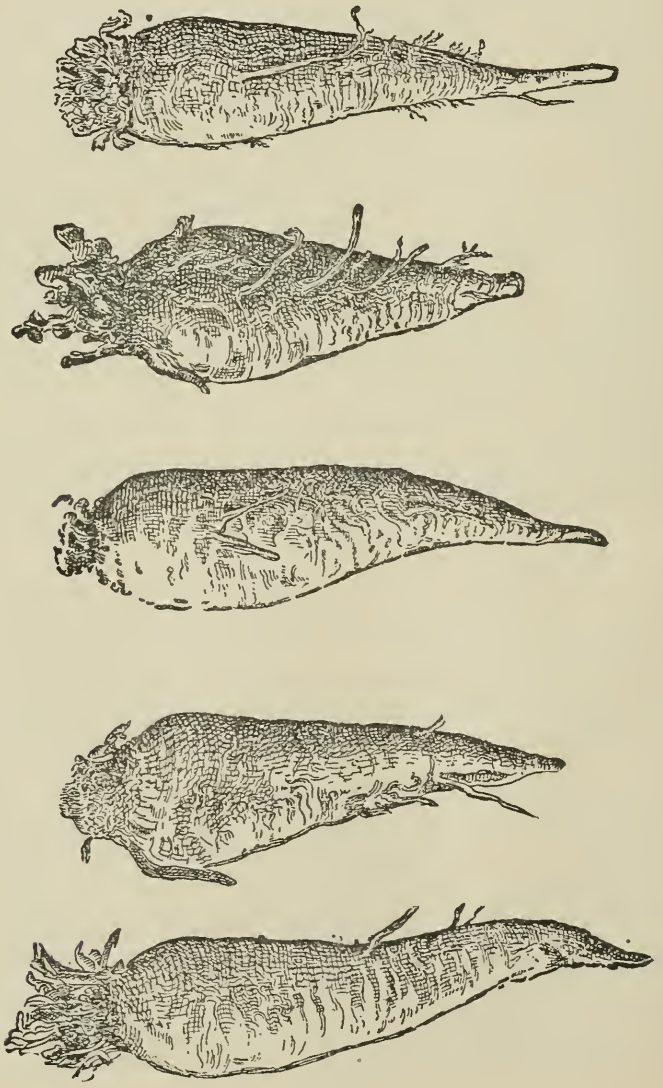
From the handling of thousands of beets at Grand Island, I have been able to identify stunted and many legged beets with a shallow and poor tillage.

The depth of the homogeneous mellow soil-bed is of great importance, for the deeper it is the longer and better will the roots be, and the easier will they take moisture and plant food from the soil, and more than this, the root will have a symmetrical form.

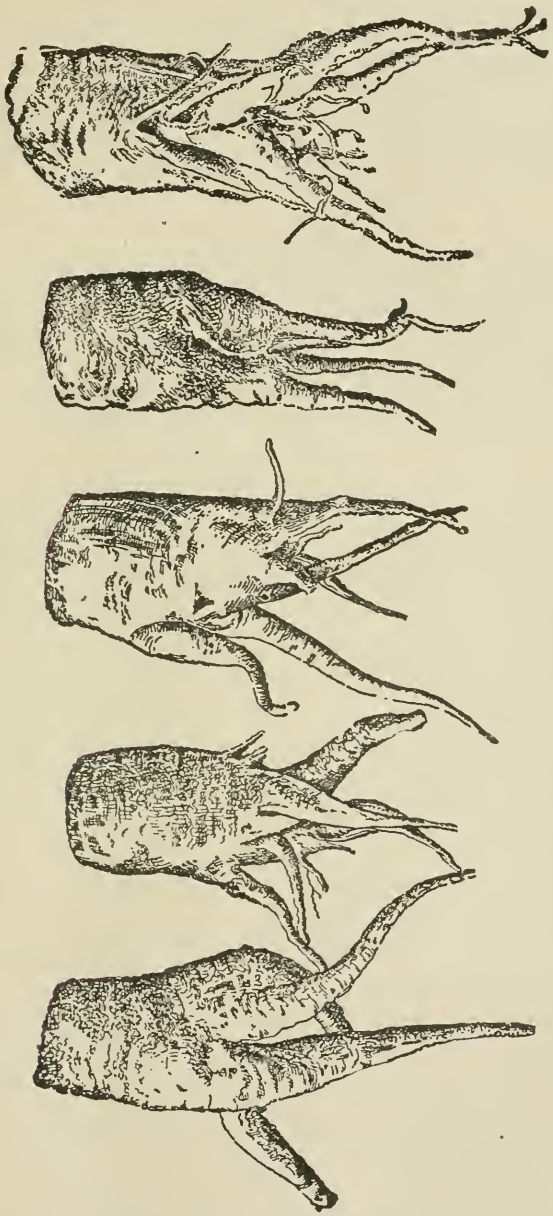
And we must not stop content with a good seed-bed when we desire good beets, but we must follow up the subsequent culture assiduously.

To make the point clearer than is possible with words we beg to call especial attention to the accompanying plates.

The first plate represents beets of white Silesian variety grown on good soil and with proper care and plenty of cultivation. The beets are of good form and show good characteristics, and would be sought after by factory.



The second plate represents beets of white Silesian variety grown on same soil from same kind of seed, but without proper care and with insufficient cultivation. They have no good characteristics, and are dreaded by factory, and are only fit for forage purposes.



In 1893 the average weight of the root on the 20th of July was 55 grams. In 1892 the root at this time weighed 107 grams. The ratio of increase for the two years was the same; the roots quadrupling in weight during August. *We cannot escape the conclusion that thorough and deep preparation of the ground in the fall and the earliest possible planting of the seed in the spring are the most potent factors in producing a large*

yield. If possible, April planting should be the rule. The dangers of frost can be in part overcome by using large amounts of seed and in getting a thick stand, affording mutual protection.

Again, the sugar yield is more the function of the climate and frequent and thorough cultivation. The *ratio* of increase in the sugar content was greater in 1893 than in 1892. While, this season, the sugar content on July 20th was 8.6 per cent. against 8.8 per cent. in 1892, yet by September 6th it had reached 10 per cent., a rate of increase even greater than that of the previous season, when the sugar content only reached 9.4 per cent. on September 8th. *The facts indicate, very plainly, that if we can induce a rapid growth and larger weight of the root in the early part of the season the sugar content will take care of itself in the latter part, even if the season is hot and dry.* (*Nebraska Reports.*)

In conclusion, I beg to mention the names of my assistants, Mr. Robert Harcourt, B.S.A., and Messrs. W. A. Kennedy, B.S.A., A. T. Wiancko, B.S.A., and P. B. Kennedy, B.S A , all of whom rendered valuable service in the dairy investigations. But I am particularly grateful to Messrs. Harcourt and W. A. Kennedy, who have given much of their private time when it was needed. I also desire to express my appreciation of the new method of heating the laboratory and the adjoining buildings. The amount of heat that is furnished by the system will, it appears, be quite sufficient on the coldest days.

Respectfully submitted,

A. E. SHUTTLEWORTH,
Prof. of Chemistry.

PART V.

REPORT OF THE

PROFESSOR OF VETERINARY SCIENCE.

To the President of the Ontario Agricultural College :

SIR,—I have the honor of submitting to you my annual report for the year 1895.

During the different terms of the year I have lectured and demonstrated to the students as follows : To the 1st year students on veterinary anatomy and veterinary materia medica, also a course of practical stable lectures. The subjects taken by the 2nd year were veterinary pathology, veterinary obstetrics, the laws of breeding and a course of lectures on practical horse. In the latter I take a horse into the class-room and point out the desirable and undesirable points and the conformation of the different classes of horses, explain and demonstrate the different modes of administering medicines, applying bandages, poultices, fomentations, etc., also the methods of securing horses for minor operations, the general care of the feet, the normal appearance of a healthy horse, as compared with that of a deceased one, as regards the pulse, respiration, external temperature, condition of the coat, appearance of the mucous membranes, general actions, etc., etc. To the special dairy class I delivered a short course of lectures on the ordinary diseases of dairy cattle. I have endeavored to make all lectures as plain and practical as possible.

As you are aware, there have been no text-books for the students on my subjects, which necessitated a great deal of dictation during lectures. This made progress comparatively slow. During the summer I prepared and had printed in pamplet form, notes on veterinary anatomy and pathology. I supplied the students with these books at 75 cents each, which appears a high price, but as there is no demand for them outside the College, it will be some years before I shall realize, even at this price, sufficient from the sale to cover the actual cost of publication. I find that the use of the printed notes makes a great improvement in the course of instruction in these subjects. I may, with your approval, get notes on other subjects printed later on.

The live stock class-room in the new experimental building is an improvement and a great advantage, it having many advantages over the old class-room in the College building proper. Allow me to congratulate the Hon. Minister of Agriculture and yourself on securing such excellent facilities for teaching and demonstrating the different subjects. I am especially pleased with the live stock class-room, and, as far as my subjects are concerned, I consider the arrangements complete under existing circumstances, that is as my time is not fully occupied at the College. If at any time the Government should consider it wise to employ the whole time of the Professor of Veterinary Science, he would have opportunities to carry on extensive experiments, which might prove valuable ; and in such a case, it would be necessary to have increased accommodation and appliances ; but this is a matter upon which I do not consider that I

should here express an opinion. Besides my work in the class-room, I have given professional attention to the live stock of the institution, and I am pleased to be able to report that the losses have been comparatively light. Below will be seen particulars.

Horses. We had a case of strangles in the dairy horse, a few cases of lymphangitis, several of influenza, a few serious cases of acute indigestion, also cases of colic, calks, sore shoulders, sore necks, worms and other minor cases in the farm horses, but in all cases prompt and careful treatment resulted in recovery.

Cattle. During my absence attending institute meetings in January, there occurred a fatal case of gastritis in a steer. There were a few cases of difficult parturition, some of retention of the placenta, metritis, mammitis, indigestion, impaction of the rumen, fardel bound, paraplagia, eczema, etc., etc., but they all made perfect recoveries.

I dehorned 20 head of dairy cattle, and after giving both the saw and the clippers a fair trial, in private practice as well as in the dairy herd, I strongly favor the clippers, as by their use the operation can be performed much more quickly and consequently with less pain, and the after results are the same. There are a great many kinds of clippers in use, most of them of American manufacture. The difficulty appears to be the making of a machine that has sufficient power to enable a man to remove a large horn without assistance. As dehorning is becoming general in many sections (and I think it is probable it will become more general) it is of great importance that the operators have a machine that gives satisfaction, and I am pleased to be able to state that the most satisfactory machine in the market is manufactured in the Province of Ontario.

During the past season I have tested a few animals for tuberculosis; but all the animals tested have passed or stood the test.

Sheep. There were some losses in our flocks, especially in lambs, from wool balls in the pyloris. This is a trouble in lambs that appears almost impossible to avoid, especially in early lambs. Last spring Mr. Rennie arranged compartments in the pens, which would not admit the ewes. In these the lambs were supplied with finely pulped roots, which satisfied their hunger and prevented them from nibbling at their mother's fleece and swallowing the wool. This arrangement proved helpful, but did not entirely stop the practice. We lost one ewe from rupture of the uterus while lambing, another from metritis, and a lamb from gastritis. We were not troubled with tape-worm in the lambs. The treatment adopted the two preceding years appears to have been effectual in getting rid of these pests. The treatment was as follows: I made a decoction of pumpkin seeds, and administered to each lamb the product of from one to two and a half ounces of the seeds (according to the size of the lamb). This was done every ten days, from the middle of May to the first of September.

Pigs. There was no fatality among the pigs, with the exception of some newly born ones.

Respectfully submitted,

J. HUGO REED, V.S.

Guelph, December 27th, 1895.

PART VI.

REPORT OF THE

PROFESSOR OF DAIRYING.

To the President of the Ontario Agricultural College:

SIR,—I beg leave to present the report from the Dairy Department for 1895. The past year has been a busy one in experimental work in connection with the dairy. I am indebted to the instructors of the Dairy School, to my assistants in butter-making, cheese-making, and the dairy stable, and to the gentlemen who have come to the dairy from time to time to score cheese and butter. I would not forget to thank the students of the Dairy Class of 1895 for their patience and forbearance in the trying times of vaccination and quarantine, especially the two lady students, Miss Jackson and Miss Campbell.

You will find my report under the following heads:

I DAIRY SCHOOL.

II. EXPERIMENTAL WORK: CHEESE-MAKING, BUTTER-MAKING, FEEDING.

III. DAIRY STOCK.

IV. TRAVELLING DAIRY.

V. EUROPEAN DAIRYING.

VI. MISCELLANEOUS DAIRY NOTES AND EXPERIMENTS.

I. DAIRY SCHOOL.

The Dairy School opened January 14th with about one hundred students in attendance, of whom eleven were in the Home Dairy. Owing to an outbreak of smallpox which occurred the first week of the Dairy School, many were deterred from coming who would otherwise have been here and some few went home after quarantine was over. Happening as this did at the commencement of the session, it rather put a damper on the course. Eighty men and two lady students lived in the dairy buildings for nearly two weeks, and our experiences during that time were not of the most pleasant nature. Some sixty-three, including two ladies, wrote on the final examinations, of whom fifty-six were granted certificates, having successfully passed the practical and written examinations. A few have sent in reports during the season and are now entitled to Special Professional Certificates.

We have endeavored to make this course as practical as possible, following along the lines indicated in my last report, and making such changes and improvements as suggested themselves from time to time. The students who come for this special dairy course are a fine class as a rule and a credit to the dairy industry of the country.

II. EXPERIMENTAL WORK.

Experiments in the Manufacture of Cheese.

The experiments in the Cheese Department were conducted by Mr. R. W. Stratton, a graduate of our Dairy School. The work covered the following points :

1. The effect of different percentages of fat in milk on the quantity and quality of cheese produced.

2. The effect of dipping at different stages of acid on the curd.

3. The effect of different quantities of salt on curds from normal, rich and poor milk.

4. The effect of cooking temperatures on normal, rich and poor milk.

*5. The effect of different temperatures for setting milk.

*6. The effect on the curd of milling at different stages of acid.

*7. The effect of different temperatures of curd at the time of putting to press.

8. Effect of different quantities of rennet in milk on the quantity and quality of spring cheese.

Some of these experiments were made in the months of November and December. Consequently, the cheese are unfit for judging at this time, and the report on these will be made in a special bulletin early in 1896, with the consent of yourself and the Honorable the Minister of Agriculture. The conclusion of the experiments on the relation of fat in milk to the quantity and quality of cheese produced must be held over until the November and December cheese are properly ripened. I hope to give in this special bulletin the results of the work done in these two months, together with a summary of the two years' work done in the department in relation to this important question of the relative values for cheese-making purposes of samples of milk containing different percentages of fat. At this time, I shall merely report the data up to the end of October and leave the conclusions largely until the whole year's work is in a condition to report upon.

Relation of Fat in Milk to Quantity and Quality of Cheese.

These experiments commenced April 10th and continued on the average three days each week from May to December. During April, but six trials were made. Unless stated otherwise, two vats were used daily, each containing 300 pounds of milk. The milk was chiefly bought from three farmers in the vicinity of the dairy. Our own herd contributed some of the milk. The plan adopted to secure rich and poor milk was to test each cow in the four herds every two weeks. The milks from the rich and the poor cows were kept separate until reaching the dairy, when the cans were tested with a Babcock tester and the milks carefully weighed before being put into the vats. We were unable to secure so wide a variation in the percentage of fat as we would have liked, owing to the limited quantity of milk we had to choose from. The average difference in the percentage of fat in the two lots of milk was in the neighborhood of one per cent., which is about the average variation in milk supplied to cheese factories. There were a great many difficulties in the way of successfully carrying on these tests during a period of nine months, but most of them were overcome. We are indebted to Messrs. MacLaren, Bell and Brill for their assistance in scoring the cheese. No doubt the work might have been done differently, but, on the whole, it has been satisfactory. We submit the results to date and hope to summarize the two years' work later on. I shall group the results into spring, summer and fall months, and give the chief conditions of manufacture for the three periods. The detailed results and averages of each month I will give in tabular form.

* Not completed at time of preparing report, but will be reported on later.

April.

Relation of fat in milk to quantity and quality of cheese.

Date.	Per cent. fat in milk.	Lbs. fat in milk.	Lbs. of cheese.		Lbs. milk for 1 lb. cheese.		Lbs. cheese for 1 lb. fat in milk.		Per cent. fat in whey.
			Green.	Cured.	Green	Cured	Green	Cured	
1895.									
April 10	4.1	12.3	34.	32.5	....	.....	.....	.....	0.23
	3.35	10.05	30.25	28.75	.. ...	.....	.....	.....	0.20
" 11	4.20	12.6	34.	32.5	.....	.....	.. ..	.....	0.15
	3.30	9.90	29.25	27.75	.....	.....	.....	....	0.15
" 17	4.20	12.6	34.	32.25	. .	.....	.....	....	0.18
	3.70	11.10	30.25	28.75	.....	.....	.....	.....	0.18
" 18	4.10	12.30	33.25	31.75	.....	.....	....	.....	0.22
	3.20	9.60	28.50	27.00	.....	.....	.....	....	0.18
" 24	4.40	13.20	33.50	32.00	. ....	.....	.....	.....	0.25
	3.50	10.30	28.50	27.25	.....	.....	.....	.....	0.15
" 25	4.30	12.90	33.25	31.50	.....	.....	.....	. ..	0.15
	3.30	9.90	28.25	26.75	.....	.....	.....	.....	0.10
Average for rich milk	4.21	75.9	202 00	192.5	8.9	9.3	2.66	2.54	0.19
Average for poor milk	3.39	61.05	175.00	166.25	10.3	10.8	2.86	2.72	0.16

May.

April 30	4.30	12.9	33.00	32.00	.... .	.....	.... .	.....	0.20
	3.20	9.6	26.75	25.25	....	.....	.....	.....	0.20
May 1	4.00	12.00	33.25	32.00	.....	.....	.....	.....	0.20
	3.20	9.60	27.00	25.50	.....	.....	.....	.....	0.15
" 2	4.35	13.05	34 50	33.00	.....	.....	.....	.....	0.25
	3.15	9.45	27.25	26.00	.....	.....	... ..	.....	0.15
" 7	4.10	12.30	32.50	30.00	.. ..	.....	.....	....	0.25
	3.20	9.60	26.00	24.50	.....	....	.....	.....	0.15
" 8	3.9	11.70	31.25	29.75	.....	.....	.....	....	0.20
	3.3	9.90	26.75	25.25	.. ..	....	. ...	.....	0 20
" 9	3.90	11.70	31.25	29.75	.....	.....	....	.....	0.22
	3.30	9.90	26.00	24.50	.....	....	... .	.....	0.18
" 14	4.20	12.60	33.50	32 00	.....	.....	.....	.....	0.25
	3.5	10.50	30.25	29 00	....	.....	.....	.....	0.20
" 15	4.00	12.00	32.50	31.00	.....	.....	. ....	.....	0.15
	3 70	11.10	30 00	28.50	....	....	.....	.....	0.15
" 16	4.10	12.30	33.75	32.00	.... .	.....	.....	.....	0.25
	3.40	10.20	29.50	27 50	.....	.....	.....	.....	0.15
" 21	4 20	12.60	35.00	33.25	.....	.....	.....	.....	0.22
	3.50	10 50	32.00	30.00	.... .	.....	.....	.....	0.18
" 22	4 30	12.90	33.50	31.50	... .	.....	.....	.....	0.30
	3.40	10.20	29.00	27.50	.. ...	.....	.... .	.....	0.20
" 23	4.00	12 00	32 00	30.25	.....	.....	.....	.....	0.25
	3.40	10.20	28.00	26.50	.....	.....	.....	.....	0.20
" 28	4.10	12.30	35.25	33.50	.....	.....	.....	.....	0.20
	3 40	10.20	31.25	29.50	.... .	.. ...	.. ...	. ...	0.15
" 29	4.00	12.00	32.00	30.50	.....	.....	.....	.....	0.25
	3.10	9.30	27.75	26 25	.....	.....	.....	.. ..	0.20
" 30	3.90	11.70	31.75	30.00	.....	.....	....	.....	0.20
	3.00	9.00	27.50	26.00	.....	.....	....	.....	0.15
Average for rich milk	4.09	184.05	495.00	470.50	9.09	9.98	2.68	2 55	0.22
Average for poor milk	3.30	149.25	425.00	401.75	10.58	11.21	2.84	2.69	0.17

JUNE.

Date.	Per cent. fat in milk.	Lbs. fat in milk.	Lbs. of cheese.		Lbs. milk for 1 lb. cheese.		Lbs. cheese for 1 lb. fat in milk.		Per cent. fat in whey.
			Green.	Cured.	Green	Cured	Green	Cured	
1895.									
June 4	4.20	12.60	32.50	30.75	.....	.....	.. ..	...	0.22
	3.40	10.20	28.25	26.75	.....	.....	.....	.. ....	0.18
" 5	3.70	11.10	31.00	29.75	.....	.....	.....	.....	0.20
	3.30	9.90	28.25	27.00	.....	.....	.....	.....	0.20
" 6	4.00	12.00	33.25	31.75	.....	.....	.....	...	0.20
	3.10	9.30	28.25	27.00	.....	....	.....	.....	0.22
" 11	4.00	12.00	32.00	30.25	.....	.....	. ....	.....	0.20
	3.00	9.00	27.00	25.50	.....	.....	.....	.. ...	0.15
" 12	3.90	11.70	31.50	30.00	.....	.....	.....	.....	0.22
	3.2	9.60	28.00	26.50	.....	.....	.....	.....	0 15
" 13	4.00	12.00	32.50	30.75	...	....	.....	.....	0 20
	3.00	9.00	28.00	26.50	.....	.....	.....	.....	0.10
" 18	4.00	12.00	31.75	30.50	....	....	.....	.....	0.20
	3.00	9.00	27.25	26.00	.....	. ....	... ..	.....	0.20
" 19	4.00	12.00	31.00	29.50	.....	.....	... ..	.....	0.20
	3 10	9.30	28.25	26.75	.....	.....	.....	.....	0.15
" 20	3.90	11.7	31.75	30.00	.....	.....	.....	.....	0.18
	2.90	8.7	28.25	26.75	....	.....	.....	.....	0.15
" 25	4.00	12.0	32.00	30.25	.....	.....	.....	.....	.....
	3.60	10.8	29.25	27.75	.....	.....	.....	.....	.....
" 26	3.80	11.4	31.75	29.00	.....	.....	.....	.....	.....
	3.20	9.6	27.25	26.00	.....	.....	.....	.....	. ....
" 27	3.80	11.4	30.50	28.50	.....	.....	.....	.....	.. ...
	3.20	9.6	28.00	26.50	.....	.....	.....	.....	.....
Average for rich milk	3.94	141.9	381.50	361.00	9.43	9.92	2.68	2.54	0.15
Average for poor milk	3.16	114.0	336.00	319.00	10.71	11.29	2.94	2.80	0.12

SPRING MONTHS. The chief conditions of manufacture in the spring months—April, May and June—were as follows: The rennet test at setting varied from seventeen to twenty seconds; the temperature at setting was eighty-six degrees; the amount of rennet was one ounce of Hansen's per 300 pounds of milk; coloring was used as required to give the proper shade; the time required for coagulation was about thirty minutes; the curds were cooked to ninety eight degrees; they were dipped in about two and a half hours, with one-eighth of an inch of acid; milling was done about half-way between dipping and salting, or when the curds were meaty and showed about one inch of acid on the iron; the amount of salt used was two and a half pounds per one hundred pounds of curd; the cheese were pressed about twenty hours in a gang press with a spring head; they were then weighed carefully, marked and placed in the curing room at a temperature of about sixty-five to seventy degrees; at the end of one month they were weighed again and scored by expert judges who came to the dairy for that purpose. Samples of the whey were taken by collecting all the drippings and pressings of each cheese separately and mixing these with the whey as run off the vats. All work was done carefully and systematically. It was necessary to use a "starter" nearly every day.

SUMMER MONTHS. During July and August, the conditions of manufacture were similar to the spring conditions, except in the weather, the ripening of the milk and the cooking and salting of the curds from rich milk. The weather was warm and the milk worked faster; consequently it was not ripened so much before setting. July 2nd, the milk was ripened to eighteeen seconds; and on August 22nd, the milk was ripened to but twenty-seven seconds. Commencing July 18th, the rich milk curd was cooked to 99° instead of 98°; and in the latter part of August, the temperature was increased to 100°, and the amount of salt to two and three-quarters and three pounds per 100 pounds of curd, instead of two and one-half. Cooking to 100° and adding three pounds of salt made the cheese somswhat harsh in texture.

JULY

Date.	Per cent. fat in milk.	Lbs. fat in milk.	Lbs. cheese.		Lbs. milk to 1 lb. cheese.		Lbs. cheese to 1 lb. fat in milk.		Per cent. fat in whey.
			Green.	Cured.	Green	Cured	Green	Cured	
1895.									
July 2	3.90	11.70	30 00	28.75	.....	.....	.....	.. ..	0.20
	3.30	9.90	28.00	26 75	.....	.....	.....	.....	0.20
" 3	.....	.....	.....	.....	.....	.....	.....	.....	.....
	3.00	9 00	28.00	26.50	.....	.....	.....	.. ...	0 20
" 4	3.70	11.10	29 50	28.00	.....	.....	.....	. ....	0.20
	3.10	9.30	27.75	26.25	.....	.....	.....	.....	0.20
" 9	3.50	10.50	30 00	28 25	.....	.....	.....	..	0.20
	2.70	8.10	26.50	25.00	.....	.....	.....	.....	0.20
" 10	4 00	12.00	33.50	31 75	.....	... .	.....	.....	0.15
	3 00	9.00	28.50	27.00	.....	.....	.....	.....	0 10
" 11	3 90	11 70	32.00	30.50	.....	.....	... ..	.....	0.15
	3.00	9.00	28.25	26.75	.....	.....	.....	.....	0.15
" 16	3 70	11.10	30.75	29.00	....	.....	....	.....	0 20
	3.00	9.00	27 25	25.50	.....	....	.....	.	0.15
" 17	3.50	10.50	29 50	28.00	.....	....	...	.. .	0 35
	2.90	8.70	27.50	26.25	.....	.....	.....	.....	0.25
" 18	3.70	11.10	30 50	29 25	.....	.....	.....	.....	0.25
	2.90	8.70	27.75	26 50	.....	.....		.....	0 20
" 23	3.50	10.50	29.75	28.25	.....	.....	.....	.....	0.20
	3.05	9.15	27.00	25.50	.....	.....	.....	.....	0.15
" 24	4.20	12.60	32.75	31.25	.....	.... .	.....	.....	0.25
	2.95	8.85	27.25	25.50	....	.....	.....	.....	0.15
" 26	4.00	12.00	31.75	30 50	.....	.....	.....	.....	0 30
	3.15	9.45	28.00	26.50	.....	. ...	.....	.....	0 20
" 30	3.65	10.95	31.25	29.75	.....	.. ..	.....	.....	0 20
	3.10	9.30	27 50	26 00	.....	.....	.....	.....	0.20
" 31	3 90	11.70	31 50	30.25	.....	.....	.....	.....	0.22
	2.95	8.85	27.25	26 00	.....	.. ...	.....	.....	0.18
Average for rich milk	3 78	147.45	402 75	383 50	9.68	10.17	2 73	2 61	0 22
Average for poor milk	3.00	126.30	286 50	366.00	10 86	11.50	3 06	2.90	0.18

AUGUST.

August 1	3.65	10 95	31 00	29 75	....	.....	. ....	.....	0 20
	3 10	9.30	29 50	28.00	....	.....	.....	.....	0.20
" 6	4 30	12.90	32 25	30.50	....	.....	.	.....	0.25
	2 85	8.55	27 25	25.75	.....	.....	.....	.....	0 20
" 7	3.70	11.10	31.75	29.25	....	.....	..	.....	0.25
	2.90	8.70	27 50	26.25	.....	....	.....	.....	0 20
" 8	3.60	10 80	29.75	28.25	.....	.....	.....	.....	0.30
	2.80	8 40	27.25	25.75	.....	.....	.....	.....	0.20
" 13	3.50	10 50	30.75	29.25	.....	.....	....	.....	0 22
	2.80	8.40	27.25	25.75	.....	.....	.....	.....	0 15
" 14	3 95	11.85	31 50	30.25	.....	.....	.....	.....	0.30
	2.90	8.70	28 25	26.75	.....		.....	. ....	0 20
" 15	3.60	10.80	30.75	29.25	.....	.....	.....	.....	0.20
	2.80	8.40	27.00	25.50	.....	.....	.. ..	.....	0.20
" 20	4.00	12 00	32 75	31.25	.... .	.....	.....	.....	0.25
	3.00	9.00	28.00	26.75	.....	.....	.....	.....	0 20
" 21	3.55	10 65	30.75	29.50	.....	.....	.....	.....	0.20
	2.85	8.55	28.50	27.00	....	....	.....	.....	0.10
" 22	4.30	12.90	34.50	33.00	. ....	.....	.....	.....	0.25
	3.00	9 00	27.75	26.50	.....	... ..	.....	.....	0.20
" 27	4.00	12.00	31 50	30 25	.....	.....	.....	.....	0 25
	2.70	8.10	25.75	24 75	.....	.....	.....	.....	0.20
" 28	3.90	11.70	31.25	29 75	.....	.....	.... .	.....	0.30
	2.90	8.70	25.50	24.25	.....	.....	.....	.....	0.25
" 29	3.60	10.80	29.75	28 50	.....	.....	.... .	.....	0.20
	3.30	9.90	27.75	25.50	.....	.....	.....	.....	0.20
Average for rich milk	3.82	148.95	408.25	388.75	9.55	10.03	2.74	2.61	0.24
Average for poor milk	2.91	113.70	357.25	338.50	10.91	11.52	3.14	2.97	0.19

Fall Months. During the latter part of August and up to the middle of September, one patron fed brewers' grains to his cows. I was away from the College at the time and the cheese-maker did not know what was the matter with the milk for some days. It was not until after my return, about the middle of September, that the person stopped feeding the "grains." A few of the August cheese were tainted and all of the Septembers. The taint continued to exist for nearly two weeks after the feeding of the "grains" had been stopped. The results as to yield, etc., were not affected materially, but the quality of the cheese we have left out altogether in the month of September.

The milk was ripened more before setting in October, and experiments were made in these months as to the effect of temperature in cooking and of salt on curds from rich milk. These points will be discussed under the head of quality in the cheese.

I wish to call particular attention to the fact that in every month the poor milk produced more cheese per pound of fat in the milk than did rich milk per pound of fat. There seems to be no exception to this rule in all our experiments; therefore we may consider that point settled. The yield of cheese is not in the same ratio as the fat in the milk.

September.

Relation of fat in milk to quantity and quality of cheese.

Date.	Per cent. fat in milk.	Lbs. fat in milk.	Lbs. cheese.		Lbs. milk to 1 lb. cheese.		Lbs. cheese to 1 lb. fat in milk.		Per cent. fat in whey.
			Green.	Cured.	Green	Cured	Green	Cured	
1895.									
September 3	3.90	11.70	32.25	30.25	.....	.....	.....	.. ..	0.25
	3.20	9.60	29 75	27.75	... .	.....	.....	.....	0.22
" 4	3 90	11.70	32.25	30.75	.....	.....	.....	.....	0.22
	3.40	10 20	28 75	27 25	.....	.....	.....	.....	0.15
" 5	3.95	11.85	32.00	30 50	.....	.....	.....	.....	0.30
	3.10	9 30	27 75	26 25	.....	.....	.....	.....	0 20
" 10	4.10	12.30	32 50	31 00	.....	...	.....	.....	0.30
	2 90	8 70	27.00	25 50	.....	.....	.....	.....	0.20
" 11	4 00	12 00	30.00	28 75	.....	.....	.....	.....	0.25
	3.00	9.00	27 00	25.50	.....	.....	.....	.....	0.20
" 12	3 80	11.40	31.00	29 75	.....	.....	.....	.....	0 25
	3.00	9 00	27 25	25.75	.....	.....	.....	.....	0.20
" 17	4 15	12 45	32 75	31.25	.....	.....	.....	.....	0.25
	3.10	9 30	28.50	26 75	.....	.....	.....	.....	0.15
" 18	3 85	11.55	32.50	31.00	.....	.....	.....	.....	0 20
	2 75	8 25	27.75	26 25	.....	.....	.....	.....	0.15
" 19	4.40	13 20	33.50	32 25	.....	.....	.....	.....	0 30
	3 20	9 60	29 50	27 75	.....	.....	.....	.....	0 20
" 24	3 90	11.70	32 50	30 75	.....	.....	.....	.....	0.25
	3.25	9.75	29 25	27 75	.....	.....	.....	.....	0.20
" 25	4 10	12.30	33.75	32.50	.....	.....	.....	.....	0 25
	3.00	9.00	27.75	26.50	.....	.....	.....	.....	0 20
" 26	4 10	12.30	33 00	31 50	.....	.....	.....	.....	0.20
	2.80	8.40	26 50	25.00	.....	.....	.....	.....	0.25
Average for rich milk	4 01	144 55	388.00	370.25	9.27	9.72	2.68	2 56	0.25
Average for poor milk	3.06	110.10	336.75	318 00	10.69	11.32	3.06	2.88	0.19

OCTOBER.

Relation of fat in milk to quantity and quality of cheese.

Date.	Per cent. fat in milk.	Lbs. fat in milk.	Lbs. cheese.		Lbs. of milk to 1 lb. cheese		Lbs. cheese to 1 lb. fat in milk.		Per cent. fat in whey.
			Green.	Cured.	Green	Cured	Green	Cured	
1895.									
October 1	4.25	12.75	34.00	32.50					0 25
	3.35	10.05	30.25	28.75					0.20
" 2	4.20	12.60	34.25	32.75					0.20
	3.20	9.60	29.75	28.25					0.20
" 3	4.00	12.00	32.75	31.25					0.25
	3.10	9.30	28.75	27.25					0.20
" 8	3.85	11.55	34.00	32.50					0.20
	3.00	9.00	29.75	28.25					0.15
" 15	3.80	11.40	34.00	32.50					0.20
	3.00	9.00	29.50	27.75					0.15
" 16	3.90	11.70	33.25	31.75					0.20
	3.20	9.60	28.75	27.25					0.20
" 17	4.00	12.00	34.50	33.00					0.20
	3.40	10.20	31.00	29.50					0.15
" 22	4.00	12.00	34.25	32.50					0.20
	3.40	10.20	29.25	27.75					0.20
" 23	3.70	11.10	33.00	31.50					0.20
	3.20	9.60	29.25	27.75					0.20
" 24	4.30	12.90	33.75	32.25					0.25
	3.45	10.35	30.25	28.75					0.20
" 29	3.90	11.70	34.75	33.00					0 20
	3.30	9.90	30.75	29.25					0.20
" 30	4.10	12.30	34.75	33.25					0.20
	3 30	9.90	30.75	29.25					0.20
" 31	3.90	11.70	32.25	30.75					0.25
	3.50	10.50	30.50	29.25					0.20
Average of thirteen experiments for rich milk	3.99	155.70	439.50	419.50	8.87	9 29	2.82	2.69	0.21
Average poor milk	3.26	127.20	388.50	369.00	10.03	10.56	3.05	2.90	0.18

LOSS OF FAT IN WHEY.

The amount of fat lost in the whey is an important factor in the questions before us. The average percentage of fat in the whey was given in a previous table, but I will place the percentages for the different months side by side, that we may see and discuss them more clearly.

Month.	Average per cent. of fat in	
	Whole milk.	Whey.
April	4.21	0.19
	3.39	0.16
May	4.09	0.22
	3.30	0.17
June	3.94	0.15
	3 16	0.12
July	3.78	0.22
	3.00	0.18
August	3.82	0.24
	2.91	0.19
September	4.01	0.25
	3.06	0.19
October	3.99	0.21
	3.26	0.18

It will be seen that the average percentage of fat in the whey from the rich milk was always slightly higher than in that from the poor milk. There was not a great deal of difference, it is true, but still enough to make quite a difference in the total amount of butter-fat in the whey tank at the end of a year in a large factory. In the whey from some lots of very rich milk manufactured in December, the loss of fat was much greater than in the whey from normal milk.

Loss in Weight of the Cheese made from Rich and Poor Milk During one Month in the Curing Room.

All the cheese made from the milk of different qualities were weighed when taken from the press and again at the end of one month. The percentage of loss or loss per one hundred pounds of green cheese made from rich and from poor milk during each month was as follows:

Month.	Cheese made from	
	Rich milk.	Poor milk.
	Per cent.	Per cent.
April	4.7	5.0
May	4.9	5.4
June	5 3	5.0
July	4.8	5.3
August	4.7	5.2
September	4.5	5.6
October	4.5	5.0

It will be seen that the cheese made from the poorer milk lost a greater percentage in weight while curing. The explanation of this is likely found in the fact that the cheese made from the poorer milk were smaller, and consequently there was a greater surface exposed for evaporation per one hundred pounds of cheese. There may be other causes, but this suggests itself to my mind as the chief one.

Effect of Higher Cooking and Salting of Rich Milk Curds in these Experiments.

We will take the month of October to illustrate the effects of higher cooking and higher salting on the rich milk curds. On October 1st, the cheese made from milk testing 4.25 per cent. of fat, the curd of which was cooked to one hundred degrees and salted three pounds to the one hundred pounds of curd, was scored sixteen points out of twenty for texture. The judges pronounced it pasty. The other cheese made the same day out of 3.25 per cent. milk was also pronounced pasty. The following day (October 2nd), the cheese made from 4.2 per cent. milk, cooked to ninety-eight degrees and salted two and a half pounds was pronounced "mushy"—or was still softer in texture and body. Its mate made from 3.2 per cent. milk was "pasty." Also on October 3rd and 8th, the cheese from both lots of milk were weak in body. Evidently in these cases some other element entered to affect the quality of the cheese other than fat, temperature and salt. What that element was is difficult to say definitely, but in all probability it was too much moisture left in the curd. Right here comes in a factor that is as important as any in the manufacture of cheese, viz., the skill and judgment of the maker. All these things render cheese-making a complex study, and he is a bold man who says he knows all about it or that any *one element* is the controlling factor in the making of fancy cheese. Each part is necessary to the other. Good cheese cannot be made without butter-fat, neither can it be made without salt or water. A nice combination of skill, good milk, utensils, and agents (rennet, salt, etc.,) is needed to manufacture the finest cheese. October 16th, a cheese made out of 3.9 per cent. milk, which had been cooked to ninety-eight degrees and salted two and a half pounds to the one hundred pounds of

curd, scored thirty one points in flavor, nineteen in closeness, fourteen in color, and nineteen in texture—or ninety-three altogether. The next day (October 17th) a cheese made out of four per cent. milk cooked to one hundred degrees, and salted three pounds, scored thirty-one points in flavor, eighteen in closeness, fourteen in color, and 18.5 in texture—91.5 altogether. It will thus be seen how careful one should be about drawing conclusions from one or two experiments. I shall cite but two more experiments on the point. On October 29th, one vat of milk testing 3.9 per cent. of fat, which was cooked to one hundred degrees and salted three and a quarter pounds, scored ninety points. The other vat testing 3.3 per cent. of fat, which was cooked to ninety-eight degrees and salted two and three-quarter pounds, scored ninety-two points. October 30th, the cheese made from 4.1 per cent. milk, which was cooked to ninety-eight degrees and salted two and three-quarter pounds, scored ninety-one points, while the other cheese made from 3.3 per cent. milk and treated exactly the same in every way, scored ninety-three points. Truly there are many mysteries in connection with cheese-making.

Practical Application to Cheese Factory Work.

In this part, I desire more especially to call attention to the application of the results of all this work to the methods of dividing proceeds among patrons of cheese factories. The principles underlying the three methods now in use I discussed in my report of last year and at the dairy conventions of 1895; therefore, I need not repeat them. The addition of two per cent. to the fat readings, as seen in the table, gives results corresponding closely to the actual value of the cheese produced. In the case of those months in which the milk averaged *over* four per cent. of fat, the two per cent. system does not give quite so much money as the cheese are entitled to. From 3.82 per cent. up to 3.99 per cent. of fat in the milk, the addition of two per cent. to fat readings gives a slight advantage to the richer milk. This is as it ought to be, as we need from 3.25 to 3.75 (or an average of about 3.5) per cent. of fat in the milk in order to make good cheese; but I have yet to see that it is any advantage to manufacture milk containing four per cent. of fat and over into Canadian Cheddar cheese. Such milk can more profitably be made into butter.

It is possible that adding the exact percentage of casein to the fat as proposed by our chemist may be more scientifically correct than adding a common number, two, to all percentages of fat; but it is more complicated and not so easily applied as the single number, which is near enough for all practical purposes, especially when we consider that most of the percentage of casein above two per cent. is represented by the fat and casein lost in the whey.

Month.	Lbs. of milk	Average % fat in whole milk.	Lbs. of cured cheese made.	Reckoning cheese at eight cents. per lb. each lot would receive the following amounts of money when paid according to			
				Weight of milk	% of fat.	% of fat + two.	Weight of cheese.
				$ c.	$ c	$ c.	$ c.
April	1,800	4.21	192.50	14 35	15 90	15 36	15 40
	1,800	3.39	166.25	14 35	12 79	13 33	13 30
May	4,500	4.09	470.50	34 89	38 53	37 31	37 64
	4,500	3.30	401.75	34 89	31 24	32 47	32 14
June	3,600	3.94	361.00	27 20	30 17	29 11	28 88
	3,600	3.16	319.00	27 20	24 23	25 29	25 52
July	3,900	3.78	383.50	28 87	32 30	31 06	30 68
	4,200	3.00	366.00	31 09	27 66	28 90	29 28
August	3,900	3.82	388.75	29 09	32 99	31 56	31 16
	3,900	2.91	338 50	29 09	25 18	26 62	27 08
September	3,600	4.01	370.25	27 53	31 07	29 78	29 62
	3,600	3.06	318.00	27 53	23 98	25 27	25 44
October	3,900	3.99	419.50	31 54	34 72	33 59	33 56
	3,900	3.26	369.00	31 54	28 36	29 49	29 52

Quality of Cheese Produced from the Rich and Poor Milk.

As previously noted, all the cheese made from the milk containing the different percentages of fat were judged by capable men. The scale of points used was the following:

Flavor	35
Closeness	20
Even color	15
Texture	20
Finish	10
Total	100

The tables give the possible score and the actual points scored by the cheese made from the two lots of milk during each month. The possible score is got by multiplying the points given for each quality (such as flavor, etc.,) by the number of experiments or cheese made in each month, *e. g.*, six experiments in April made it possible for each lot of cheese made from rich and poor milk to score (6 × 35) 210 points in flavor; (6 × 20) or 120 points in closeness, and so on with each. The points scored are obtained by adding together the points given by the judges to each cheese for flavor, closeness, etc.

April.—Six experiments.

	Possible score.	Cheese made from milk averaging	
		4.21% fat. Points scored.	3.39% fat. Points scored.
Flavor	210	189	185
Closeness	120	106	103
Even color	90	80	78
Texture	120	104	100
Finish	60	60	60
Totals	600	539	526

May —Fifteen experiments.

	Po sible score.	4.09% fat in the milk. Points scored.	3.30% fat in the milk. Points scored.
Flavor	525	459	443
Closeness	300	273	272
Even color	225	210	215
Texture	300	254	255
Finish	150	150	150
Totals	1,500	1,346	1,335

JUNE —Twelve experiments.

	Possible score.	3.99% fat in the milk. Points scored.	3.16% fat in the milk. Points scored.
Flavor	420	357	349
Closeness	240	216	213
Even color	180	168	168
Texture	240	214	207
Finish	120	120	120
Totals	1,200	1,075	1,057

JULY.—Thirteen experiments.

	Possible score.	Cheese made from milk averaging	
		3.78% fat. Points scored.	3.00% fat. Points scored.
Flavor	455	388	400
Closeness	260	225	229
Even color	195	186	192
Texture	260	215	222
Finish	130	130	130
Totals	1,300	1,144	1,173

AUGUST.—Thirteen experiments.

	Possible score.	3.82% fat. Points scored.	2.91% fat. Points scored.
Flavor	455	365	369
Closeness	260	233	230
Even color	195	180	179
Texture	260	229	233
Finish	130	130	130
Totals	1,300	1,137	1,141

October.*—Thirteen experiments.

	Possible score.	3.99% fat in milk. Points scored.	3.26% fat in milk. Points scored.
Flavor	455	389.5	387.0
Closeness	260	236.0	231.5
Even color	195	185.0	185.0
Texture	260	233.5	234.0
Finish	130	130.0	130.0
Total	1,300	1,174.0	1,167.5

While not wishing to draw definite conclusions until the whole year's experiments are completed, or in fact until we have made several years' experiments in relation to the question, the results of the six months' tests as to the quality of the cheese produced from rich and poor milk are as follows :—The total score of seventy-two lots of cheese made from milk averaging 3.98 per cent. of fat (practically four per cent.) was 6,415 points, out of a possible score of 7,200. The total score of the same number (seventy-two) of cheese made from milk averaging 3.17 per cent. of fat was 6,399½ points out of a possible 7,200, a difference of 15½ points in favor of the cheese made from the richer milk. In 1894, the total score of cheese made from milk averaging 3.94 per cent. of fat was 3,852½ points out of a possible 4,300. The cheese made from milk averaging 3.37 per cent. of fat scored 3,896 points out of a possible 4,300, or a difference of 43½ points in favor of the cheese made from what we might call average milk.

As I have stated elsewhere, we must have a certain percentage of fat in the milk (say 3 5 on the average), in order to make good Cheddar cheese ; but there does not seem to be any particular necessity of having four per cent. milk or over, in order to make good Canadian Cheddar cheese.

Dipping Spring, Summer and Fall Curds at Different Stages of Acid.

The acid which a curd contains is commonly measured with a hot iron, by placing a piece of curd next to a clean iron heated to a proper temperature. In these trials the acid varied from "sweet" to one-half an inch on the iron. About one-eighth of an inch gave the best results in spring cheese, although a very nice cheese was made with one-quarter of an inch of acid. The texture seemed to be best at about one-eighth of an inch. Curds dipped sweet, or nearly so, seemed to break down more easily or were softer in texture, but lacked keeping quality. Further trials are needed to settle the point as to the right amount of acid to give spring curds. We would advise about one-eighth of an inch.

From July to October some further tests are made in which the acid of one vat was allowed to develop as much as one and one-quarter inches on the hot iron. It will be noticed by the table that so much acid on the curd did not produce so fine cheese as a rule, nor was the yield of cheese quite so great. Three hundred pounds of milk were used in each vat, the milk having been previously mixed together, so as to have the same quantity and quality in each vat.

*As previously explained, the scoring of the September cheese is not given, owing to the bad flavor caused by one patron feeding brewers' grains. As this tainted milk was in some cheese and not in others, it would be impossible to make comparisons.

Effect of dipping at different stages of acid.

Date.	Amount of acid.	Hours from dipping to salting.	Lb. cheese from 300 lb. milk.	Per cent. fat in		Score.
				Milk.	Whey.	Max. 100.
		hrs. min.				
April 16	⅛ inch	3 ..	29.75	3.60	0.20	88
	1-16 "	3 35	29.75	....	0.20	87
" 19	¼ "	3 16	28.50	3.60	0.30	88
	⅛ "	3 31	28.25	....	0.30	90
" 20	⅛ "	3 18	28.75	3.60	0.18	90
	Perceptible	4 5	28.50	....	0.18	89
" 22	⅛ inch	3 15	29.00	3.60	0.22	90*
	Sweet	4 29	28.75	....	0.22	88
July 19	⅛ inch	3 ..	28.00	3.6	0.15	87
	1-16 "	2 26	28.00	... .	0.15	86
Aug. 2	¼ "	3 ..	27.25	3.3	0.15	89
	⅛ "	3 20	27.25	.....	0.15	93
" 16	⅛ "	3 20	26.75	3.4	0.2	86
	Perceptible	4 35	27.00	.....	0.2	88
" 30	⅜ inch	3 25	28.50	3.4	0.2	89
	1-16 "	4 19	26.50	.....	0.2	91
Sept. 13	⅝ "	2 58	28.75	3.3	0.15	87
	¼ "	3 30	28.75	.....	0.15	88.5
" 27	¾ "	2 30	29.00	3.4	.2	87.5
	¼ "	3 12	29.25	.....	.2	85.5
Oct. 11	1 "	2 5	28.50	3.4	.2	89
	¼ "	3 3	29.00	....	.2	91.5
" 25	1¼ "	2 21	30.50	3.5	.2	88.5
	½ "	3 13	31.00	.....	.2	90.5

Effect of Salt on Curds from Normal, Rich and Poor Milk.

For these experiments 600 pounds of milk were treated as usual, up to the salting stage, when the curd was divided as evenly as possible and different quantities of salt added to the curd. The amount per 100 pounds of curd varied from one-quarter of a pound to three and one-half pounds in the spring. Cheese with a small amount of salt —say up to one pound per 100 pounds of curd—are weak in body and texture and insipid in flavor. The best spring cheese at the end of twenty-three days was made (April 29th) by using salt at the rate of two pounds per 100 pounds of curd. The other half of the curd was salted at the rate of three pounds per 100. This latter cheese did not score quite so high at the end of twenty-three days, but on June 14th (when about six weeks old) it was better in flavor than the cheese salted at the rate of two pounds per 100. It would seem that about two and one-half pounds of salt per 100 pounds of curd would be about right for spring cheese. But in this a maker must use his judgment, putting more salt on a moist curd and less on a dry one.

The amount of salt should be increased during the summer and fall. A difference of half a pound of salt per 100 pounds of curd did not seem to affect the quality of the cheese to any considerable extent so long as the quantity was somewhere near three pounds of salt per 100 of curd during the summer and fall. The table shows the results.

* These two cheese were kept for a while in the curing room. On June 14th the cheese which had been dipped with one-eighth inch of acid was still the better cheese. The sweet curd cheese was soft.

Effect of salt on curd from milk with average per cent. of fat.

Date.	Lbs. milk.	Per cent. fat in milk.	Lbs. salt per 100 lb. curd.	Lbs. cheese.		Score.
				Green.	Cured.	Max. 100.
			lb.			
April 23	916	3.70	$\frac{1}{4}$	48.25	46.00	74
			$1\frac{1}{4}$	49.00	47.00	88
" 26	793	3.60	$\frac{1}{2}$	41.75	41.00	80
			$1\frac{1}{2}$	39.50	39.00	83
" 27	777	3.60	1	39.50	37.75	82
			$1\frac{3}{4}$	39.25	37.50	83
" 29	800	3.60	2	40.00	38.50	90
			3	39.50	38.00	89
May 3	715	3.40	$2\frac{1}{2}$	33.25	31.50	83
			$3\frac{1}{2}$	32.50	30.75	86
June 15	600	3.60	$2\frac{1}{2}$	31.50	30.00	86
			3	31.00	29.50	86
" 29	600	3.70	$2\frac{1}{2}$	31.50	29.75	89
			$3\frac{1}{4}$	32.00	30.25	89
July 13	600	3.70	$2\frac{3}{4}$	31.50	29.75	86
			$3\frac{1}{4}$	31.75	30.00	86
" 27	600	3.7	$2\frac{3}{4}$	30.25	28.75	84
			$3\frac{1}{3}$	30.00	28.58	84
Aug. 10	600	3.6	$2\frac{3}{4}$	30.25	28.50	90
			$3\frac{1}{2}$	29.75	28.25	91
" 24	600	3.6	$2\frac{3}{4}$	30.50	29.00	85
			$3\frac{3}{4}$	29.75	28.50	89
Sept. 7	600	3.6	3	30.25	29.00	87
			$3\frac{3}{4}$	30.25	29.00	88.5
" 21	600	3.7	3	30.25	29.00	91.5
			4	29.75	28.50	89
Oct. 19	600	3.6	$2\frac{3}{4}$	31.50	29.75	90
			$3\frac{1}{2}$	31.50	29.75	89.5
" 26	600	3.4	$2\frac{3}{4}$	30.25	29.00	89
			$3\frac{1}{4}$	30.75	29.75	90.5

Owing to the difficulty of securing a sufficient amount of rich milk, there were not a sufficient number of experiments to warrant us in laying down any hard and fast rule, but the results indicate that rich milk curds should be salted more heavily than poorer milk curds. The tendency of cheese made from rich milk is towards a "pasty" texture and poorer keeping quality. An extra amount of salt remedies this to some extent. Curds from four per cent. milk and over need to be salted at a higher rate than other curds. The quantity will vary with the season, the amount of moisture in the curd, and the length of time the cheese are to be kept before they are placed on the market.

Effect of salt on curd from rich milk.

Date.	Lbs. milk.	Per cent. fat in milk.	Lbs. salt per 100 lb. curd.	Lbs. cheese.		Score.
				Green.	Cured.	Max. 100.
			lb.			
May 4	600	4.00	2½	31.50	30.00	91
			3½	30.75	29 25	95
" 10	615	3.85	1	32.00	30.75	82
			2½	30.25	29.25	88
" 18	600	4.00	2¼	33.25	31.75	87
			2¾	33.00	31.50	87
June 1	600	3.80	2½	30.00	28.75	88
			3	29.75	28.50	87
Oct. 5	600	3.80	3	33.00	31.25	90
			4	32.25	30.75	92.5

The general results indicate that less salt should be used per 100 pounds of curd when the latter is derived from poor milk—say about three per cent. of fat. It will be noticed that there are cases when the higher salted curds made slightly better cheese. For instance, September 28th and October 12th. In both cases this is due to an improved flavor. If the milk or curd is not first-class in flavor, heavier salting will no doubt tend to improve the flavor.

Effect of Salt on Curd from Poor Milk.

Date.	Lbs. milk.	Per cent. fat in milk.	Lbs. salt per 100 lb. curd.	Lbs. cheese.		Score.
				Green.	Cured.	Max. 100.
			lb.			
May 11	600	3.35	1	29 50	27.75	81
			2½	28.75	27.00	89
" 25	600	3.30	2½	29.00	27.25	86
			5	28.50	27.00	86
June 8	600	3.30	1½	28.50	26.75	90
			2½	28.50	27.00	90
" 22	600	3.00	2½	29.50	27.50	91
			1¾	28.75	27.00	91
July 6	600	3.10	2	28.25	26.75	78
			2½	28.00	26.50	78
July 20	600	3.00	2¼	28.50	28.25	89
			2¾	27.00	26.50	88
Aug. 3	600	2.90	2½	27.50	26.00	83
			2¾	27.75	26.25	87
" 17	600	3.00	2¾	27.50	26.25	91
			3	27.50	26.25	87
" 31	600	3.00	2¾	27.50	26.00	85
			3¼	27.25	26.00	86
Sept. 14	600	3.30	3	30.00	28.50	.....
			3½	30.25	29.00	.....
" 28	600	3.10	3	29.50	28.25	87.5
			3¾	28 00	27.00	88.5
Oct. 12	600	3.20	2½	30.25	29 00	88.5
			3	30.25	28.75	89.5

The cooking of curd made from milk with an average per centage of fat in it (from 3.4 to 3.7) to 100° or over, does not appear to be of any advantage, except in the case of curds which have a bad flavor. On July 29th, the curds were "gassy" and the cooking to 100° improved the flavor two points; but in texture the cheese was "off" one point, as compared with the curd cooked to 98°. Generally speaking, we may say, that the experiments made, indicate that the higher cooking has little or no effect on the time from setting to dipping, or from dipping to salting, and no effect on the percentage of fat lost in the whey. In two out of four trials, there was slightly less cheese made from the curds cooked to 100° and over. The effect on quality was to make the cheese somewhat harsh in texture, though it seemed to improve the flavor of a gassy curd.

Effect of temperature in cooking curds from milk with an average per cent. of fat.

Date.	Lbs. milk.	Per cent. fat in milk.	Temp. for cooking.	Hours from setting to dipping.	Hours from dipping to salting.	Lbs. of cured cheese.	Per cent. of fat in whey.	Score.
			deg.	hrs. min.	hrs. min.			
July 15	300	3.7	98	2 42	2 53	29.25	0.15	91
	300	3.7	99	2 40	3 4	29.25	0.15	91
" 29	300	3.7	98	2 45	3 6	29.25	0.20	90
	300	3.7	100	2 40	3 7	29.00	0.20	91
Aug. 12	300	3.7	98	3 3	3 42	27.50	0.20	90
	300	3.7	101	3 0	3 57	27.50	0.20	89
Sept. 23	300	3.6	98	2 58	3 20	28.75	0.20	88
	300	3.6	103	2 55	3 28	28.50	0.20	87

The experiments made indicate that one or two degrees higher temperature in cooking would improve the texture of cheese made from rich milk, say milk containing 4 per cent. of fat and over, although some of the cheese scored higher, at a lower cooking temperature. If the usual temperature for cooking is 98°, we would recommend cooking to 99° or 100° when making up milk containing over 4 per cent. of fat into cheese. The higher cooking tends to improve the body and texture and to overcome the tendency to pastiness in cheese made from rich milk.

Cooking—Rich Milk.

Date.	Lb. milk.	Per cent. fat in milk.	Temp. for cooking.	Hours from setting to dipping.	Hours from dipping to salting.	Lb. of cured cheese.	Per cent. of fat in whey.	Score.
			deg.	hrs. min.	hrs. min.			
May 6	300	4.05	98	2 34	3 3	29.00	0.15	84
	300	4.05	94	2 44	2 53	29.50	0.15	85
" 20	300	4.00	95	2 32	2 48	30.00	0.18	82
	300	4.00	98	2 32	2 55	29.25	0.18	83
June 3	300	3.08	98	2 31	3 7	28.75	0.20	91
	300	3.08	96	2 29	3 1	28.75	0.20	92
" 17	300	3.08	98	2 26	2 56	29.25	0.15	89
	300	3.08	97	2 21	3 ..	29.00	0.15	90
Aug. 26	300	3.08	98	2 30	3 47	28.50	0.20	86
	300	3.08	102	2 27	3 47	28.50	0.20	87
Oct. 21	300	3.08	98	3 42	3 42	29.00	0.20	89.5
	300	3.08	104	3 44	3 40	28.50	0.20	90

The general results of the effect of cooking temperatures indicate that one or two degrees lower than normal (98°) would have a beneficial effect on curds from poor milk, say milk containing from 2.90 to 3.25 per cent. of fat. This is presuming that the usual quantity of salt is used. The effects of cooking, salting, stirring, dipping, milling, etc., when combined, are so complex that it is difficult to say just what are the effects of any one of these operations in the manufacture of cheese. Then again, the maker's skill and judgment come into play so often that it makes the whole question a very intricate one. More light is needed on these points. It will require years of patient research to settle the many questions which arise in the manufacture of cheese and butter.

Effect of Different Temperatures for Cooking Curds.

Cooking—Poor milk.

Date.	Lbs. milk.	Per cent. fat in milk.	Temp. for cooking.	Hours from setting to dipping.	Hours from dipping to salting.	Lbs. cured cheese.	Per cent. fat in whey.	Score.
			deg.	h. m.	h. m.			
May 13	300	3.4	98	2 37	2 47	27.75	0.15	87
	300	3.4	90	2 54	3 17	28.50	0.15	86
" 27	300	3.2	98	3 6	3 53	27.00	0.12	88
	300	3.2	91	3 2	3 58	27.25	0.12	91
June 10	300	3 3	98	2 59	3 58	26.25	0.1	89
	300	3.3	92	3 7	3 45	26.50	0.1	91
" 24	300	3.0	98	1 57	2 45	26.25	0.00	86
	300	3.0	94	2	2 35	26.25	0.00	86
July 8	300	3.0	98	2 35	3 13	25.50	0.15	84
	300	3.0	94	2 39	2 56	25.75	0.15	84
" 22	300	2.9	98	2 33	3 25	24.50	0.15	90
	300	2.9	95	2 28	3 43	24.50	0.15	89
August 5	300	2.95	98	2 17	2 47	26.00	0.15	84
	300	2.95	95	2 12	2 51	26.00	0.15	84
" 19	300	2.8	98	3 9	3 5	26.00	0.15	86
	300	2.8	97	3 6	3 6	25.75	0.15	87
September 2	300	3.4	98	3 23	3 40	27.75	0.15	73.5
	300	3.4	99	3 20	3 50	28.00	0.15	75.5
" 16	300	3.4	98	2 42	3 45	29.00	0.15	90
	300	3.4	100	2 37	3 55	29.00	0.15	90
" 30	300	3.3	98	3 4	3 42	28.75	0.2	89
	300	3.3	101	2 55	3 52	28.50	0.2	88
October 28	300	3.3	98	2 57	3 25	29.00	0.15	90.5
	300	3.3	102	3 22	3 1	29.00	0.15	91

Effect of Different Quantities of Rennet on Spring Cheese.

Beginning April 3rd, nine experiments were made to determine the effect of different quantities of rennet used in milk on the quantity and quality of cheese. Six hundred pounds of milk were mixed in a large vat, and the coloring and "starter" added after it was brought to a temperature of eighty-six degrees. The milk was then equally divided between two vats of 300 pounds in each. The milk was ripened in both vats to about nineteen or twenty seconds, and then the rennet was added, varying in quantity from one ounce per 1,000 pounds of milk to nine ounces per 1,000 pounds of milk. The extreme quantities of rennet were always added to one of the vats, and the other vat was set with about the normal quantity used in spring cheese. Salt was used at the rate of two and a half pounds per 100 pounds of curd.

In the experiments where but one and two ounces of rennet per 1,000 of milk were added, the time required for coagulation was too long and considerable cream rose to the top. As a consequence the percentage of fat in the whey was high, .3 and .2 per cent.; and the yield of cheese was less, being half a pound less in the case of one ounce and

a quarter of a pound less where two ounces of rennet were used. This loss was on 300 pounds of milk and would amount to considerable in a large vat. There also seemed to be less yield of cheese where the extra large quantities of rennet were used, and more loss of fat in the whey.

Effect of rennet in cheese-making.

Date.	Rate of rennet per 1000 lbs. milk	Rennet test. Seconds	Minutes coagulating.	Time from setting to dipping.	Time from dipping to salting.	Lb. cheese from 300 lbs. milk	Per cent. fat in Milk.	Per cent. fat in Whey.	Score. May 22nd, Max. 100.
	oz.			h. m.	h. m.				
April 3	3 1	19	30 65	2 25 2 41	3 20 3 3	28.75 28.25	3.65	0.15 0.30	86 83
" 4	3 2	19	33 42	2 33 2 27	3 8 3 9	29.75 29.50	3.65	0.15 0.20	87 88
" 5	3 2½	20	36 40	2 39 2 40	3 53 3 50	29 25 29.00	3.65	0.15 0.20	91 92
" 6	3½ 4	20	27 23	2 29 2 26	3 20 3 27	29.75 29.25	3.60	0.18 0.18	85 86
8	3½ 5	20	27 20	2 47 2 44	3 3 3 6	30.00 29.75	3.65	0.20 0.20	88 89
" 9	4 6	18	23 16	2 26 2 33	3 45 3 38	29.00 29.00	3.50	0.20 0.20	85 87
" 12	4 7	20	28 16	2 50 2 47	3 3 8	29.25 29.25	3.50	0.15 0.15	86 89
" 13	4½ 8	20	26 15	2 33 2 36	3 27 3 32	30.00 29.50	3.60	0.18 0.18	89 89
" 15	4½ 9	20	25 13	2 36 2 44	3 38 3 10	29.75 29.50	3.6	0.20 0.25	89* 89

The best cheese were made on April 5th, when three ounces and two and a half ounces of rennet were used per 1,000 pounds milk. These two cheese the experts pronounced "very good spring cheese."

April 15th, rennet was used at the rate of four and a half ounces in one vat and nine ounces per 1,000 pounds milk in the other. These cheese were scored on May 22nd by two experts who said that there was little or no difference in the two cheese. These two cheese were kept and judged again on June 25th, when the cheese with the large quantity of rennet (nine ounces per 1,000 pounds milk) was scored two points "off" in flavor, while the four and a half ounce cheese had kept its flavor well, and gained one point in closeness.

The table shows the chief points in the experiments. Similar experiments were made in November and December, but the cheese are not sufficiently cured to report this year.

Experiments in Creaming and Butter-making.

The past year has been a busy one in the Experimental Dairy. As soon as the dairy school was over I arranged a series of experiments to be conducted in the Cheese and Butter Departments. The cheese experiments have been reported. While we have been paying special attention to our cheese work we have not neglected the butter. This branch of the dairy will require special attention in the coming years.

* On June 25th these two cheese were scored again after having been kept for a month, and the cheese made by using four and a half ounces of rennet scored 90 points, and the cheese made with nine ounces of rennet scored 88 points. The former improved one point and the latter deteriorated a point.

The experiments in the butter department were conducted by Mr. T. C. Rogers' our butter-maker. Each day in the week was set apart for a certain line of experiments' and, as far as practicable, this has been adhered to. For instance, on Monday of each week experiments were made to compare the three systems of creaming milk—separator, deep setting and shallow pan. Tuesdays were devoted in observing the effect of washing on butter. On Wednesdays a number of different experiments were made. Thursdays were given up to sweet cream churnings; Fridays, to the best methods of ripening cream; and Saturdays, to miscellaneous experiments. While the students were at the College the time taken for instruction in the dairy interfered more or less with our experimental work. I trust that during 1896 we shall be able to systematize the work even better than during 1895, as it is only by doing systematic and carefully planned experimenting that we may hope to accomplish any considerable amount of the great deal of work which yet remains to be done in the dairy.

Creaming of Milk in Shallow Pans at Different Temperatures.

This is a continuation of experiments made on similar lines in 1893 and 1894. This year the experiments were made in October, the month when farmers begin to bring in the milk pans from the milk cellar and put them in the pantry or around the kitchen stove to keep the milk warm so that the cream may rise. Three hundred pounds were set in pans in a cool place, and 300 pounds of the same kind of milk (having been first well mixed with the former) were set in a warmer place. Fifteen trials were made in all. Twenty pounds of milk were set in each place. The average temperature at which the milk was set in the cool place was 78.1°. The average temperature when skimmed was 44 1°. The temperature of the room varied from forty to fifty degrees. The average percentage of fat in the skim-milk was .39.

The other lot of milk set at the same average temperature in a room where the heat varied from forty-eight to seventy degrees and the average temperature of the skim-milk was 54.1° (ten degrees higher than the other) contained .45 per cent. of fat in the skim-milk.

For three years we have had better results in creaming milk with shallow pans set in a cool room than in setting milk in these pans in a warmer place. We are satisfied that it is a mistake to carry milk in shallow pans into the pantry or kitchen in order to keep the milk warm for the cream to rise. A nice cool milk cellar where the milk will not freeze is much better—better, in order to get the cream to rise, and better for the flavor of the butter.

Hours Required for Cream to Rise on Deep Pails.

From April to December, twenty-two trials were made, comparing twelve, twenty-four and thirty-six hours' setting of milk in deep cans in ice water. During the summer months twelve hours' setting gave good results, but in November and December the skim-milk from twelve hours' setting contained over .5 of one per cent. of fat. The twenty-four and thirty-six hours' setting had considerably less. The average loss of fat during the whole season in the skim-milk, skimmed at a temperature of 41.1 degrees in twelve hours, was .44 per cent. of fat, and the cream contained 18.1 per cent. of fat. A portion of the same kind of milk, skimmed at twenty-four hours, contained .372 per cent. of fat in the skim-milk and 20.34 per cent. of fat in the cream. The remaining third of the milk, skimmed at thirty-six hours, contained .31 per cent. of fat in the skim-milk and 21.13 per cent. of fat in the cream.

The practical lessons from these trials are:

1. In winter, when the cream does not rise so readily and there is little or no danger from souring of the milk or cream before skimming, the milk should be set from twenty-four to thirty-six hours before being skimmed. When the cows are fresh and the weather is warm, and the dairyman has plenty of ice, skimming at twelve hours will give best results.

2. In one trial in November, where no ice was used, but the milk was cooled with water to forty-seven degrees before skimming, the loss of fat in the skim-milk was 1.0 per cent. at twelve hours, .9 per cent. at twenty-four hours, and .6 per cent. at thirty-six hours. *It pays to use ice and cool the milk rapidly.*

3. The longer the milk stands, the richer will be the cream. Some makers have the cream so thin that it takes a long time to churn and makes more labor than is necessary in winter. Allow the milk to sit a longer time and obtain thicker cream, which is less troublesome to churn.

Influence of Temperature in Deep Setting of Milk.

During May, July and August, ten trials were made to determine the influence of temperature in deep setting of milk. Three hundred pounds of milk were set at an average temperature of eighty degrees in ice water and skimmed at an average temperature of 41.4 degrees. The loss of fat in skim-milk was .206 when set for twenty-four hours. An equal quantity of the same milk was reduced to 46.7 degrees and the skim-milk tested .316 per cent. of fat. Another portion of this milk was set in cold water which reduced the temperature of the milk to 52.4 degrees. The loss of fat in the skim-milk set under such conditions was .71 per cent., or over three-quarters of a pound of butter to 100 pounds of skim milk. Yet this is the manner in which a great many dairymen set their milk for farm butter-making and for the cream-gathering creamery. These latter conditions are even better than the average farm conditions, as it is doubtful whether by using ordinary well water without ice the milk is cooled to even 52.4 degrees. How long shall this waste of butter continue?

In nine experiments made with 270 pounds of milk brought to the dairy by patrons furnishing milk for the cheese department, which had been hauled some three or four miles before being set under conditions similar to the above, the loss of fat in skim-milk was .25 per cent. from milk at 40.5 degrees; .44 per cent. from milk at 46.6 degrees, and .65 per cent. from milk at 51 6 degrees.

Separating Milk at Different Temperatures.

To throw some light on the question of the best temperature for separating milk with the cream separator, we made a number of trials from April to October. We used the Alexandra separator (Nos. 2 and 3) for this work.

In twenty-eight trials, where the average temperature of skimming was 82.2 degrees, there was left in the skim-milk an average of .09 per cent. of fat, and the cream contained 26.44 per cent. of fat. A portion of this same milk was heated to an average temperature of ninety-seven degrees, in which case the skim-milk contained .065 per cent. of fat, and the cream 28.04 per cent. of fat. Another portion of the same milk was heated to 107.7 degrees and the skim-milk tested an average of .065 per cent. of fat, and the cream 29.39 per cent. of fat. The remaining portion was heated still higher, to an average of 118.2 degrees, and the skim-milk tested .062 per cent., and the cream 30.9 per cent. of fat.

The results were that the higher temperature of the milk at separating showed (1) less loss of fat in the skim-milk (feed and speed of the machine remaining constant as far as possible in all the trials); (2) a higher percentage of fat in the cream, and (3) in the case of the Alexandra separators, the cream was smoother at the higher temperature. The butter made from the samples of cream separated at the different temperatures was quite similar in quality. We need, of course, to consider the expense of heating the milk and cooling the cream. Nevertheless, it would often pay the users of the Alexandra separators in the winter to separate at a much higher temperature than is now common. It would increase the capacity of the machine, give smoother cream, cause a higher percentage of fat in the cream and less loss of fat in the skim-milk, while there would not be so much danger of spoiling the grain or body of the butter in winter.

Diluting Cream with Water and Separating the Second Time.

It has been claimed by some that if cream was diluted with from one to six times its volume of water and run through the separator a second time it would improve the quality of the butter, as it would cause a more complete separation of the caseous or curdy matter. In some trials made during the past year it was found that such a practice did not improve the quality of the butter—in fact, it rather injured the body of the butter and did not improve the flavor. Water added to cream in any large quantity spoils the flavor to some extent, and the more that cream is hauled about and handled, the poorer is the quality of the butter, as a rule. The more quickly the cream is churned and the less handling it receives, consistent with good buttermaking, the better the quality of the butter.

Separating Milk Containing Different Percentages of Fat.

Sixteen trials were made from April to October to see the effect on the cream of separating milk containing different percentages of fat; 3,593 pounds of milk, containing an average of 4.18 per cent. of fat, were run through an Alexandra separator at an average temperature of eighty-five degrees. This amount of milk produced 543 pounds of cream, containing an average of 26.47 per cent. of fat. The skim-milk averaged .08 per cent. of fat. Three thousand six hundred and eighty-five pounds of milk, separated at an average temperature of eighty-seven degrees and containing 3.3 per cent. of fat, produced 544 pounds of cream which tested 21.64 per cent. of fat. The skim-milk in this case tested .09 per cent. of fat. In the case of the rich milk (4.18 per cent. of fat), 100 pounds of it produced 15.1 pounds of cream, and the poorer milk (3.3 per cent. of fat) produced 14.7 pounds of cream per 100 pounds. The general effect seemed to be that richer milk did not produce a great deal more *volume* of cream than did poorer milk, but the cream contained a higher percentage of fat, or was richer. The *machine*, and not the richness of the milk, governs the *volume* of cream obtained from a cream separator.

Separator, Deep Setting and Shallow Pan Methods of Creaming Compared.

During the past three years we have been comparing the three common methods used for creaming milk. During 1893 and 1894 the position of the methods, as regards completeness of skimming, quantity of butter made, and quality of butter, was separator first, deep setting second, and shallow pan third. This is the relative standing for 1895 also. The table shows the chief points in the experiments by months.

By way of summary, it may be said that 3,938 pounds of milk were creamed by each method. The average percentage of fat in the whole milk was 3.66; in the separator skim-milk the fat averaged .093 per cent.; the skim-milk from deep setting averaged .29 per cent. of fat, and the shallow pan skim-milk .313 per cent. of fat. The average percentage of fat in the separator cream was 22.38; in the cream from deep setting it averaged 19.12 per cent., and the shallow pan cream averaged 18.34 per cent. of fat.

The buttermilk from separator cream averaged .135 per cent. of fat; from deep setting the buttermilk averaged .195 per cent., and from the shallow pan it averaged .24.

The total quantity of butter produced from the separator cream was 164½ pounds; from deep setting cream 160¾ pounds, and from the shallow pans 157 pounds and one ounce.

The pounds of milk required to make a pound of butter for the season was 23.91 for the separator, 24.47 for deep setting, and 25.05 for the shallow pans.

As to the quality of butter produced from the three methods, it may be said that there was not much difference in them during the cooler weather. In hot weather the shallow pan butter was not so good, but at other times it compared favorably with the other two. Taken for the nine months, the separator butter was slightly better in quality, although not *always* so.

Result of experiments in creaming milk with separator, deep setting and shallow pan.

Months.	Method of creaming.	Lbs. milk.	Temperature set and separated.	Per cent. of fat in				Temperature of milk when skimmed.	Lbs. and oz. of butter made.
				Whole milk.	Skim-milk.	Cream.	Butter-milk.		
			deg.					deg.	lbs. oz.
April	Separator	297	83	4.05	.075	23.05	.10		14 4
	Deep setting	297	83	4.05	.175	21.00	.10	38	14
	Shallow pan	297	83	4 05	.25	21.70	.17	43	13 12
May	Separator	440	85	3.77	.08	20.46	.1		19 12
	Deep setting	440	85	3 77	.23	19.20	.13	41	19 8
	Shallow pan	440	85	3.77	.26	21.60	.15	53	19 4
June	Separator	575	87	3 38	.11	24.15	.08		21 15
	Deep setting	575	87	3.38	.19	19.65	.17	45	21 11
	Shallow pan	575	87	3.38	.29	18.70	.25	64	20 4
July	Separator	560	88	3.33	.09	21.30	.14		22 4
	Deep setting	560	88	3.33	.22	18.75	.2	45	21 13
	Shallow pan	560	88	3.33	.30	15.50	.25	57	20 13
August	Separator	415	85	3 36	.08	21.40	.12		16 1
	Deep setting	415	85	3.36	.22	19 00	.15	43	16
	Shallow pan	415	85	3.36	.26	16.80	.20	60	15 8
September	Separator	536	85	3.62	.05	22.27	.16		22 4
	Deep setting	536	85	3 62	.36	18.60	.25	43	21 10
	Shallow pan	536	85	3 62	.30	19.31	.26	58	21 2
October	Separator	397	83	3.84	.06	20.50	.20		17 5
	Deep setting	397	83	3.84	.33	18.90	.18	41	16 11
	Shallow pan	397	83	3.84	.33	17.20	.2	44	16 10
November	Separator	468	79	3.72	.17	19.90	.22		19 8
	Deep setting	468	79	3 72	.45	18.20	.2	44	19
	Shallow pan	468	79	3.72	.42	17.70	.33	42	18 14
December	Separator	251	81	3.82	.09	22.05	.20		11 3
	Deep setting	251	81	3 82	.35	19.4	.3	38	10 7
	Shallow pan	251	81	3 82	.30	16.6	.35	39	10 14

Sweet Cream Butter.

For some four years we have been making experiments with churning sweet cream Our results have been practically the same throughout, viz., that butter can be made from sweet cream, which will suit a certain class of customers, who like mild, fresh, creamy flavored butter; but by the majority of persons in Canada, ripened cream butter is liked better. Other points we have learned, are :

1. We must churn sweet cream at a very low temperature (forty-five degrees or below) in order to obtain all the butter. Churning at ordinary temperatures means a great loss of fat in the buttermilk. Cream rich in butter-fat (twenty-five to thirty per cent.) gives best results.

2. Sweet cream butter does not possess "keeping quality" the same as ripened cream butter. We have found that it quickly goes off in flavor and does not improve or take on the flavor of ripened cream butter as claimed by some.

3. The temperature of the cream usually rises about ten degrees in the process of churning, indicating that the low temperature is not suitable for bringing the butter (yet necessary to start with) in order to gather all the particles of fat.

VIEW OF DAIRY DEPARTMENT, TAKEN FROM THE COLLEGE.

DAIRY BUILDING, SILO, ETC.

During 1895 eighteen trials were made, in which 1,919 pounds of cream were churned at an average temperature of 45.6 degrees at the beginning, and 55.4 degrees at the end. The time required for churning ranged from half an hour to one hour and fifty-five minutes, with an average time of one hour. The average percentage of fat in the buttermilk was 0.223.

Ripening Cream.

The most difficult part of the buttermaker's task, and the one requiring the most skill and good judgment, is the proper ripening of the cream. A number of different "starters" were used in our dairy during the past season. Of all the "pure cultures" which we have tried, there appears to be none that produced so marked an effect on the flavor of the cream and butter as Conn's Bacillus No. 41. Between August 6th and the 10th, a similar flavor to that produced by B. 41 was produced in the cream and butter by using a starter made in the ordinary way, viz., by heating some skim-milk to ninety degrees and allowing it to sour. In cream-gathering creameries, where it is difficult sometimes to get a good flavor in the butter, or in fact at any creamery or dairy where the flavor of the butter is not first-class, we would recommend a trial of Dr. Conn's "B. 41."

As a "starter" for ordinary creamery work, we would recommend pasteurizing the skim-milk (heating to 170 degrees for twenty minutes) cooling it to eighty-five degrees and then adding about five per cent. of good flavored buttermilk, or any "starter" of good flavor, in order to obtain a uniformly good-flavored cream and butter from day to day. Add from five to ten per cent. of this "starter" to the cream, and it will result in a more even flavored butter during the year.

Should we Wash our Butter?

During the past year we have made one experiment each week, by taking out about one-third of each churning, and salting, working and packing this in a tub without washing. The remaining two-thirds we washed once; and then salted, worked and packed one-half of it. The other half (or remaining third of the original churning) we washed twice and then salted, worked and packed it. We have found that by adding about twenty-five per cent. of water to the contents of the churn before drawing off the buttermilk, we thin the buttermilk and so allow a better separation of the butter, whereas, if this is not done, it is difficult to get the buttermilk from the butter. We would recommend adding in winter about ten per cent. of water at churning temperature, when the butter "breaks," and the remaining fifteen per cent. of colder water after the granules are full size. After this revolve the churn a few times to mix the water with the milk and then draw off the buttermilk and water.

As a result of the season's experiments on this point, we would recommend little or no washing where the butter is made into pound prints for customers who like highly flavored butter, and who will consume it in from eight to ten days after it is made. While we have found the unwashed butter to keep fully as well as the washed in some cases, yet the general results indicate that the former has not quite so good keeping quality as the washed butter. For packing in tubs, butter may be washed once or twice, but we feel satisfied that many makers are spoiling the flavor of their butter by too much washing. To-day (Dec. 28th) I have just examined three prints of butter, from the same churning, made at the dairy on the 18th instant, and the print of unwashed would score three or four points higher in flavor than the others which were washed. Winter butter especially should not be washed too much.

The Oil-test Churn Compared with Actual Results in Churning.

The oil-test churn has been the subject of a number of attacks from patrons of cream-gathering creameries and others. To compare this test with the actual yields of butter from the churn, twenty-seven trials were made during the months of July, August and September. Altogether, there were churned 2,385¼ pounds of cream, which made 592 pounds 5 ounces of butter. Tested by the oil-test churn method, there were 530.6 inches of cream, which varied in the test from seventy-five per cent. to 140 per cent. The total amount of butter credited in these churnings by the oil-test churn was 575.94 pounds, compared with 592.34 pounds as the actual yield, a difference of 16.4 pounds. Half of this difference was made in one day, June 30th, when the oil-test credited the churning with 29.43 pounds of butter, whereas the actual butter churned was 38.42 pounds. Why there was so much difference on this particular day, it is difficult to say.

Only three times out of the twenty-seven trials did the oil-test credit more than the actual yield from the churn.

Experiments in Feeding.

Value of Milk for Calves. Beginning May 6th, an experiment was commenced to find the relative value of skim-milk and whole milk for calves. Two grade calves, as nearly alike in age and weight as we could get, were selected. Number one, fed on skim-milk only, was dropped May 3rd and weighed sixty-one pounds on May 6th. At the end of six weeks it weighed 141 pounds, a gain of eighty pounds, or nearly two pounds per day. During this time the calf drank 714 pounds of skim-milk. Calf number two fed on whole milk (dropped April 19th) weighed seventy-five pounds at the beginning, and 201 pounds at the end of six weeks, a gain of 126 pounds, or three pounds per day.

These calves were both sold to a local butcher, who pronounced the calf fed on whole milk worth one cent a pound more than the other. The calf fed on skim-milk sold for $3.50, and the one on whole milk sold for $7.50. Allowing $1.50 as the value of No. 1 calf and $2.00 as the value of No. 2 at the beginning of the experiment, we have $2.00 as the value of 714 pounds of skim-milk, or twenty-eight cents per 100 pounds, and $5.50 as the value of 714 pounds of whole milk, or seventy-seven cents per 100 pounds. To produce one pound of gain, required 8.9 pounds of skim-milk. The whole milk gave one pound of gain for 5.6 pounds fed.

A similar experiment was commenced on two other calves at the same time, except that these received meal and some clover hay in addition to the milk. Calf No. 3, fed on skim-milk, was dropped April 17th, and weighed seventy pounds at the beginning of the experiment, May 6th, and 192 pounds at the close, May 31st. During the twenty-five days it consumed 546 pounds of skim-milk, twelve pounds of meal (made up of ground wheat, bran and oil-cake mixed in equal proportions), and nine pounds of clover hay. The gain averaged 4.8 pounds per day, which seems rather high, but this was an exceptionally hearty calf and of the age to make the best gain. With this calf, 4.5 pounds skim-milk (with the meal) produced one pound gain. The other calf, No. 4, dropped April 2nd, was fed on whole milk and the same kind of meal as No. 3, consumed 462 pounds of milk, twelve pounds of meal, and eleven pounds of clover hay. During twenty-five days it gained 110 pounds, and averaged 4.4 pounds gain per day; 4.2 pounds whole milk (with the meal) gave one pound gain in flesh. In addition, both calves were fed all the salt they would eat—three pounds each during the twenty-five days of the experiment.

Further experiments were made during the summer, but the results were not nearly so satisfactory, due in all probability, first, to the fact that the calves were from cows which had been bought to replenish the dairy herd, and were likely sired by "scrub" bulls; secondly, to the fact that during hot weather and fly time calves do not gain

so rapidly, unless extra precaution is taken. From June 3rd to July 15th, a "scrub" calf (No. 5) fed on 432 pounds of skim-milk, and thirty-four pounds of meal, gained but forty-four pounds, or a little over one pound per day. Another calf (No. 6) of similar breeding consumed 1,420 pounds of skim-milk, ninety-five pounds bran, and forty-seven pounds of oil cake from July 15th to September 24th, and gained but seventy-two pounds in that time—or about one pound per day. These two experiments illustrate the importance of *breed* as well as *feed*.

Value of Sweet Whey for Calves. Two experiments were made to determine the feeding value of sweet whey for calves. The results were not altogether satisfactory, and I think larger gains would be made with a better class of calves. The one calf (No. 7) that showed some breeding, seemed to thrive fairly well. If whey could be got sweet from the vats and fed warm to thrifty calves, they would do very well, if fed some meal in addition.

In changing the feed from milk to whey, it was done gradually. The meal was mixed with the drink for a time, and then gradually changed to a dry meal ration.

Calf No. 5, which had been previously receiving a skim-milk ration, and had gained but forty-four pounds in forty-two days, was gradually changed to a sweet whey and meal ration, which continued from July 16th to September 24th. During the seventy days it consumed 1,240 pounds of whey, 105 pounds skim-milk, sixty-seven pounds bran, and thirty-four pounds of oil cake, and gained eighty-five pounds—about the same gain as it had previously made on skim-milk and meal. This calf never seemed very thrifty. All unthrifty calves are reared at a loss to the feeder.

Calf No. 7, which was about the same age as calf No. 6, and was fed on whey during the same time that No. 6 received skim-milk (from July 15th to September 24th), consumed 1,420 pounds of whey, 105 pounds of whole milk, ninety-five pounds of bran, and forty-seven pounds of oil cake. During this time it gained fifty-five pounds, or about three-quarters of a pound per day.

Experiments in Pig Feeding.

Sweet Milk vs. *Sour Milk for Grown Pigs.* These experiments are a continuation of last year's work in this line. The first experiment commenced April 29th, with thirteen Yorkshire grade pigs—six pigs in pen No. 4, and seven in pen No. 5.

Pen No. 4 weighed 908 pounds (an average of 151 pounds each) at the beginning of the experiment. For three weeks they were fed on *sweet* skim-milk, some whey, pease, and middlings. At the end of three weeks they were weighed. During the next three weeks they were practically fed on the same ration, except that they received more of it, and *sour* skim-milk instead of sweet. Pen No. 5 weighed 1,007 pounds (144 pounds each) when they commenced on *sour* skim-milk, meal, and some whey. At the end of the first period (three weeks) they were weighed and then changed to a ration of *sweet* skim-milk and meal.

The total gain of both lots on *sweet* skim-milk was 277 pounds, and the total gain of both pens on *sour* skim-milk was 269 pounds in six weeks—practically the same.

July 15th a similar experiment was made, except that the feeding periods continued for six weeks, instead of three. The pigs were Berkshire grades.

No. 2 pen, consisting of nine pigs, weighed 904 pounds when they commenced the experiment on sour milk; and No. 3 pen (eight pigs), weighed 569 pounds when they started on sweet milk. The total gain on *sweet* milk and middlings with both lots was 517 pounds; and on the *sour* milk and middlings the gain was 991 pounds. To produce 517 pounds of gain the hogs consumed 5,476 pounds of *sweet* skim-milk, and 2,040 pounds of middlings. To produce a gain of 991 pounds required 5,770 pounds of *sour* skim-milk and 2,118 pounds of middlings.

Wet vs. *Dry Feed.* This experiment is also a continuation of last year's experiments in the same direction. The pigs were four Yorkshire grades. The experiment commenced July 15th, when they were fed on wet middlings in the form of a slop for six weeks. At the beginning of the trial the total weight was 402 pounds; and at the end of six weeks they had gained 323 pounds. During the next six weeks, from August 26th to October 8th, when they were fed dry meal, they gained but 132 pounds, or less than half what they had gained in the previous period. The explanation of this would seem to be that in the first period they were at the stage of growth when they would naturally make the greatest growth, and when changed to the dry meal they did not appear to relish it so well, and did not eat so much in proportion to weight. During the wet meal period these hogs consumed 570 pounds of middlings, and 850 pounds of skim-milk, together with a small amount of whey—fifty pounds. While fed on dry meal for six weeks they consumed 566 pounds of middlings, 840 pounds of skim-milk, and 420 pounds of whey.

Last year there did not appear to be much difference in the results from dry and wet meal, while this year there is a marked difference in favor of the wet meal. Individual characteristics of the pigs would account to some extent for differences in results *In all experimental work with live stock allowance must be made for the individuality of the animal.*

III. DAIRY STOCK.

The stock at present in the dairy consists of two pure-bred Jersey cows, one two-year old, and three yearling heifers; one Holstein cow and a yearling heifer; one Ayrshire cow; twenty-four grade cows, three yearling grade heifers, and three calves. Our cows were turned out to pasture on May 10th, the earliest since my connection with the Department. Later, however, frosts came and destroyed the excellent pasture, and it never recovered from the injury, consequently we were obliged to feed more grain and soiling crops than usual. Some silage left over from the winter also helped through the dry spell. Our plan is to sell or exchange dry and unprofitable cows for fresh milkers, so as to have some fresh cows in the herd all the time, and to keep none but first-class cows for any length of time. We have had difficulty in getting our cows in calf during the year, and two cows have aborted. We have discarded the system of watering the cows in the stalls by means of iron troughs, as we found it impossible to keep the water pure.

We have kept a sufficient number of pigs to consume the skim-milk and most of the whey from the dairy. Some of these we bought, and others we raised. Our aim is to raise the pigs needed in the dairy, but when thrifty pigs, six to eight weeks old, can be bought from $1.25 to $1.50 apiece, as I have bought them this fall, it is a question whether it pays to raise them or not.

Record of the Dairy Herd for 1895.

The following is a record of the dairy herd for 1895. As we have been buying and selling throughout the year, the record is not complete for all cows which have been in the herd during the year. Some were in at the commencement of the year, but were sold for beef during the summer, as they were unprofitable. Others were bought later in the year, and have not had time to prove their worth. Under these circumstances, I have withheld the records of all cows which have not been at the dairy for at least 200 days. We still adhere to our standard of at least 6,000 pounds of milk, or 250 pounds of butter yearly. If a cow does not reach this standard, she must go. This makes a good many changes necessary during the year. In time, we hope to build a dairy herd second to none. We have a number of promising heifers from some of our best cows. From these we shall hear later on:

Yearly Record of Dairy Cows, ending Dec. 8th, 1895.

Name of cow.	Weight.	Bred.	Calved.	No. of days milking.	Total lbs. of milk.	Per cent. fat			Total lbs. of fat.	Lbs. of milk to one lb. of fat.	Total lbs. of butter.	Remarks.
						Highest.	Lowest.	Average.				
Queen.....	1,110	Sept. 27	Apr. 28....	266	6,749	4.3	2.4	3.38	228	29.6	250.8	
Carrie.....	1,140	May 16	Mar. 16....	308	8,258	5.2	2.2	3.96	327	25.2	359.7	
Jessie.....	1,065	Sept. 20	Mar. 14....	287	7,663	4.3	2.9	3.06	275.8	27.7	303.3	
Jennie.....	965	Sept. 23	Apr. 19....	280	7,315	3.5	2.6	3.08	225.3	32.4	247.8	
BelleTemple	915	July 2	Nov. 8....	343	4,639	7.2	4.2	6.27	290.9	15.94	320	
Pansy.....	1,055	Feb. 2	Nov. 2....	287	6,723	4.3	3.0	3.52	236.6	28.4	260	
Annie.....	935	Nov. 7	Aug. 7....	315	6,569	4.8	3.0	4.38	287.7	22.4	316.4	
Birdie.....	1,115	Feb. 22	Nov. 8....	329	7,439	5.6	3.2	4.32	321.3	23.14	353.4	
Margaret...	1,460	Dec. 4	Oct. 26, '94	372	10,090	4.8	3.0	3.67	370.3	27.2	407.3	Aborted
Rebecca....	1,100	.....	.....	238	6,595	4.0	3.0	3.53	232.8	28 3	256.0	
Bella.....	1,335	June 24	Mar. 3....	280	8,402	4.3	3.0	3.55	298.2	28.16	328	
Patience ...	1,245	Apr. 23	Feb. 11....	245	6,940	5.0	2 9	4.08	281.0	24.7	309	
Star Light..	1,367	June 24	....	280	6,352	4.2	3.4	3 53	224.0	28.3	248	
Dairy Queen	1,150	June 24	.....	210	5,602	4.1	2.7	3.50	196.0	28.6	215.6	Bought in spring
Nora.....	1,165	.....	.....	224	4,992	4.2	2.5	3.19	159.24	31.34	175.1	Sold for beef
Fancy.....	.....	.....	.....	203	5,281	4.7	3.5	4.00	211.24	25.0	232.3	" "
Nancy	.....	.....	.....	217	5,200	4.8	3.0	4.05	210.6	24.06	231.6	" "
Lily	.....	.....	.....	245	4,415	4.6	3.0	3.67	162.03	27.25	178.2	" "
Fill-Pail ...	1,180	....	.....	287	4,897	4.5	3.0	3.62	177.27	27.6	195.0	Bought in spring
Mabel.....	967	.....	.....	210	5,137	3.8	2.8	3.28	168.09	30.4	185.3	" "
Dora	1,025	.....	.....	217	3,776	4.2	2.8	3.45	130.27	29.0	143.3	Sold for beef

IV. TRAVELLING DAIRY.

Prof. H. H. Dean:

SIR,—I have the honor to submit herewith my report of the work of the Travelling Dairy in 1895.

Under the direction of Dr. Mills, I left the College in the month of April, and arranged for meetings in the north riding of Ontario County and also in Victoria and Peterboro' Counties. On the 7th of May, the Travelling Dairy left the College and drove to the village of Goodwood, where at 1.30 p.m. on the 9th the first meeting of the season was held. The attendance here was small. At our meeting at Uxbridge on the day following, about twenty-five were present and much interest manifested.

Three gallons, more or less, of separator cream was supplied us for churning. Though churned at a temperature of fifty-three degrees Fahrenheit, the butter came quite soft. This was partly due to the high temperature at which it was ripened—seventy degrees Fahrenheit. Though cooled by ice water to fifty-three degrees Fahrenheit before churning, such rapid cooling did not materially affect the butter fat, as it would have done had the cream been allowed to stand at this low temperature an hour or two before churning. This is a beautifully rolling section of country, well watered and admirably suited for dairy purposes. There are no factories in the immediate vicinity, a creamery at Stouffville (eight miles distant), and a newly opened cheese-factory at Leaskdale (ten miles away) being the nearest. A sample of skim-milk from a Sharples (Russian) separator showed three-tenths of one per cent. of fat, and one from deep setting, without ice, five-tenths of one per cent. These were made the basis of an object lesson to the meeting. At Utica, the following day, the meeting was full of interest. Many, however, were

convinced, that, because of the low price of butter then prevailing, it did not pay to go to much trouble to make or market butter, apparently forgetting that it is under just such circumstances that the gilt-edged article proves its superiority from a financial standpoint.

The question of feeding calves with whey was broached and discussed. This, we submit, is a feature of our Canadian dairy practice that hitherto has not received the attention that is its due. That *sour* whey is useless for calf-feeding all must admit, but we believe that *sweet* whey may be made the basis of a satisfactory ration. Whey is not so badly balanced a food for young animals as some suppose, but it contains too much water in proportion to dry matter — 93.7. Many good calves have been raised on whey and grain rations. We would suggest the following supplement to the whey. After a week's feeding on new milk, gradually change to *sweet* whey, adding oilcake and flaxseed in equal quantities, to replace the oil and albuminoids of the milk. At two weeks old, the calf might receive whey only, with about one-quarter pound of flaxseed and one-quarter of oilcake to every two gallons of whey. Both should be boiled before adding to the whey. As soon as the calf will eat grain, ground oats with bran, oats and barley, or some like combination of grain, should be regularly supplied. Feed always at the *same temperature*, and not lower than eighty degrees Fahrenheit.

The remaining meetings held in this riding were at Sandford, Zephyr, Leaskdale, Greenbank, Pinedale, Sunderland, Wilfrid, Cannington, Beaverton, Brechin, and Uptergrove, fourteen in all. A sample of sweet-cream buttermilk, churned in nine minutes, was brought us at one of these meetings, and found to contain two and seven-tenths per cent of fat. We find that this is no isolated instance, and is but further proof of the need of close and continued examination of the by-products, that such losses may be avoided.

There was an average attendance of about thirty in this riding. The people who attended, showed much interest in the subject. There are few factories for the manufacture of either butter or cheese in this riding, but there is an inclination on the part of many towards the establishment of such, were it not that they are afraid that this branch of agriculture is likely to be overdone. At the Beaverton meeting, intense interest was manifested in regard to the use of the Babcock milk-tester in the farm dairy. The secretary of this riding, Mr. J. E. Gould, and the president, Mr. John Feasby, are certainly capable of filling their respective positions satisfactorily.

Leaving Uptergrove, we drove to the little village of Dalrymple, which lies on Mud Lake in the north-western part of Victoria County. Immense tracts of rocky plains, Trenton limestone, cover a goodly portion of this section of Victoria, with stretches of swampy land interspersed. These latter supply, during dry summer weather, much of the fodder for stock. Hence rank flavored milk is not uncommon. Little corn is grown, and not much of anything to supplement dried up pastures. Little or no attention is paid to improving the herd, but indiscriminate breeding and quite as indiscriminate feeding almost everywhere prevail.

About forty attended our meeting at Kirkfield, on May 30th. Little ambition was manifest here for dairy improvement, the majority being satisfied to take the low prices offered by the stores. After leaving this, the northernmost meeting of this riding, we lectured successively at Glenarm, Woodville, Oakwood, Little Britain and Lindsay, at all of which we had most excellent meetings, the average attendance being close to sixty.

Thanks to the secretary, Mr. Keith, of Lindsay, the meetings were well advertised.

In the west riding of this county, we held meetings as follows: Cambray, Omemee, Downeyville, Dunsford, Bobcaygeon, Fenelon Falls, Coboconk, Kinmount, Haliburton and Minden.

At Bobcaygeon, we met with Mr. Thurston, the genial secretary, and also a progressive farmer. At Fenelon Falls we met a gentleman who spoke very highly of his hand Alexandra separator and said that, in his experience, a herd of six cows would pay for the use of one. At Kinmount, a farmer was present, who had travelled seventeen miles to the meeting; he brought a sample of milk from each of his cows to be tested.

We thought as we noted the deep interest he took in the proceedings and his careful questioning, that if the dairymen of our more favored districts were equally zealous and progressive, Ontario would *at once* o'erleap itself and stand at the forefront in this industry. At Haliburton and Minden, we held royal meetings, about seventy-five present at each. We remarked that in this north country milk stood higher in percentage of fat at this season than in any other place we visited. We have asked ourselves if the continued pasturing of the cows on the unbeaten natural grasses on the slopes and river bottoms of this country for a series of years had anything to do with it.

Peterboro' County.

In the west riding, the president, Mr. J. F. Davidson, and the secretary, Mr. John A. Davidson, made arrangements for the following meetings, commencing Saturday, June 22nd: Ventress' school house, Lakehurst, Selwyn, Lakefield, Union Hall, Ennismore, Temperance Hall (Smith township), Springville and Centreville. These meetings were only moderately attended, and were without any noteworthy feature. The average attendance did not exceed twenty.

The east riding differed little in general interest and attendance from the west. We lectured and exhibited in Greystock, Keene, Westwood, Warsaw, Hall's Glen, Roman Catholic church (Douro township), school house (Douro township), and Norwood. Exception should be made from the general statement above in the case of Greystock and Hall's Glen. These meetings were intensely interesting. At the latter, sixty people were present and they were pleased to express themselves as well satisfied with the meeting, which was doubtless due, at least in some measure, to the fact that they possessed that excellent gift—the power to question wisely and well. The rather small attendance at the east Peterboro' meetings was due largely to the fact that haying and harvesting were in full operation, though the secretary, Mr. J. O'Reilly, and the president, Mr. F. Birdsall, did much to make them a success.

At the close of these meetings, the Travelling Dairy took a vacation of a couple of weeks, while harvesting operations were in progress, after which, sending our team and goods by rail 150 miles east, we found ourselves launched on a series of twenty-five meetings in the county of Russell, commencing at Vernon on the 5th of August. This was a fairly good meeting, owing largely to the interest taken and energy manifested by Mr. D. McPhail, an Associate of the O. A. C. Leaving Vernon, we visited successively Osgoode, Manotic, Nolan's school house, Billings' Bridge, Champagne Settlement school house, Cyrville school house, Taylorville, Metcalfe, Duncanville—a splendid meeting and capable chairman—Embrun, St. Albert, Casselman, South Indian, Bearbrook Station, Sarsfield, Navan's Corners, Daniston, Canaan, Cumberland, Rockland, Clarence Front, Clarence Creek, The Lake, and The Brook.

At Clarence Front, we had a very good meeting, and lectured to a people fully converted to the necessity of thoroughness in their profession. Mr. Shirreffs, an O. A. C. ex-student, supplied the cream and interested himself in various ways to secure a satisfactory meeting. We are sorry that we cannot speak so favorably of the other meetings of this county. The Farmers' Institute had not attended properly to the advertising nor yet to getting a supply of cream, which latter had been left in many cases to the pleasure of disinterested persons; in short, the general working up of the meetings had been sadly neglected and resulted in a series of the worst meetings ever held by the Travelling Dairy. We did not have the pleasure of meeting the Secretary at any of our meetings.

Prescott County.

The 10th of September found the Travelling Dairy at Wendover, on the Ottawa river. It was quite apparent, before many meetings were held here, that a great change was manifest over previous arrangements. With one exception, Curran's, out of twenty-two meetings, the cream was on hand promptly at the appointed hour, and the advertising was done with at least fair thoroughness, due in large measure to a shrewd business

capacity on the part of the genial and off-handed secretary of Prescott County Farmers' Institute, Mr. Wm. McAdam, of Vankleek Hill. Every meeting, without exception, gave evidence of the work of some master mind or minds. The president, Mr. Jonathan Cross, of Caledonia, is a competent head to this Farmers' Institute; a gentleman capable and willing and, withal, a farmer of more than usually progressive tendencies. Messrs. Cross and McAdam proved themselves men of more than ordinary executive ability, as the marked success of the tour of the Travelling Dairy in that county abundantly shows. But they did not stand alone. Mr. A. Evanturel, M.P.P., proved himself a worthy and energetic seconder in the cause of dairy development. This gentleman, at considerable trouble to himself, exercised a personal supervision over a number of the meetings held in the county, and assisted the lecturer of the Travelling Dairy at more than one meeting over the difficulty experienced with the dual languages of the county. The Travelling Dairy takes this opportunity of offering to the esteemed member for Prescott their cordial thanks for the assistance so generously rendered and the trouble taken to make their tour a satisfactory one.

Meetings were held at the following places: Wendover, Plantagenet, Curran's, Pendleton, St. Isidore, Fournier, Vankleek Hill (two days at exhibition here), Caledonia Front, Caledonia Flats, St. Amour, Horse Creek, Alfred, Lefaivre, The Marsh, L'Orignal, Henry, Hawkesbury, Chute Au Blondeau, St. Eugène, St. Anne de Prescott and Barb.

The average attendance in this county would not fall far short of forty or forty-five, and the majority of the meetings were quite satisfactory. There are a great many, in fact too many, cheese factories in this county, but knowledge of butter-making is not wide. The herds are small, very small, and, after the factory closes, the product made is so small that the people can hardly be induced to adopt the most satisfactory methods.

After our meeting at Barb, October 9th, we took train for the west and on Friday, October 18th, commenced work again at Alliston, Simcoe county, continuing with Lisle, Creemore, Dunedin, Glen Huron, Duntroon, Lawrence's school house, Batteaux, Stayner, Angus, Cookstown, Beeton, Bondhead, Croxon's Corners, Stroud, Painswick, Grenfel, Crown Hill, Minesing, Phelpston, Craighurst, Vasey, Hobart's, Orillia, Lovering, Hawkstone and Severn Bridge; twenty-seven meetings in all.

At our first meeting in this riding, we found a people thoroughly alive to their agricultural interests and possessing an active and intelligent knowledge of dairying in its varied aspects. Some fifty to sixty people were present and the meeting was characterized throughout by an actively questioning spirit. Mr. Applegate supplied the cream for this meeting. He supplies milk to the town of Alliston, and, with some others, has interested himself in the establishment of a creamery, but thus far none has been erected. The president of the Farmers' Institute in this riding, Mr. Charles Lawrence, Collingwood, and the secretary, Mr. W. A. Furlong, were present at the Duntroon meeting, and by pertinent questioning and helpful hints added much to the usefulness of the proceedings. Mr. Lawrence offered some suggestions relative to butter-making, the result of considerable observation while judging butter at our exhibitions. A sample of milk tested showed seven per cent. of fat. At several meetings there was a general expression of opinion that the too common practice of trading butter at the village stores is very reprehensible and damaging to the interests of good butter-making. The meeting at Orillia was decidedly the best in the county, about seventy-five alert and intelligent people being present. There was an average attendance of about forty throughout the county.

In the course of the past season the Travelling Dairy has addressed, at one hundred and twenty meetings, about four thousand people, made upwards of one thousand pounds of butter, and tested about as many samples of milk. I beg leave to add that Mr. M. J. Hume, my assistant, has done his work satisfactorily.

Obediently yours,

F. J. Sleightholm.

V. EUROPEAN DAIRYING.

The following notes and suggestions have been made from a hurried trip to Europe :

On my arrival in England, on the 29th of July, I proceeded at once to visit a number of the commission houses and provision dealers in Liverpool, Manchester, and Glasgow. The following firms in these places gave me valuable hints on the needs of the dairy trade and I am indebted to them for their kindness and courtesy : Messrs. Marples, Jones & Co., Geo. Fletcher, Liptons & Harrison, in Liverpool ; Fulton & Co , of Manchester ; A. Clement & Son, and R. & N. Davidson, of Glasgow. Other places which I visited in Scotland were, the Kilmarnock Dairy School, and some of the leading dairy farms in Ayrshire. The firms of Messrs. Cross at Knockdon, and Wallace at Auchenbrain, were specially interesting, as the herds of these gentlemen are probably two of the best in Ayrshire, that of Mr. Alexander Cross being especially good.

From Scotland, my route lay through the Midland Counties of England to London, from which place I made a number of short trips, the most important of which were to the Rothamstead Experiment Station and to the Aylesbury Dairy Co. From London, I proceeded to the contient, *via* Harwich and the Hook of Holland, visiting the Amsterdam Exposition, the Edam Cheese and Cattle Fair, and the Model Dairy Farm of North Holland at the Broek ; thence *via* Germany to Denmark, where most of my time was spent in visiting creameries and dairy farms on the Island of Zealand, the Copenhagen Milk Supply Co., and the Royal Veterinary and Agricultural College and Experiment Station at Copenhagen.

From Copenhagen, I crossed the Sound to Sweden and called at the Agricultural College and Experiment Station of Alnapp. I then retraced my steps to London and went *via* Southampton to the Islands of Jersey and Guernsey, where some of the leading dairy and stock farms were visited.

Wants of the Dairy Trade.

Butter. The demand seems to be for mild, fresh flavor, in all classes of dairy goods. The Danish, Irish and Australian butters are most popular. On every hand, the good qualities of Australian and New Zealand dairy products were spoken of, and every year will see stronger competition from these Colonies. Dealers seem shy of Canadian butter. The reason for this was seen in some tubs of Canadian butter which I tried in one of the warehouses. It was "greasy," and "off" in flavor. It also had what is more objectionable, a "woody" flavor. This "woody" flavor is due to the fact that the tubs were not properly prepared. Another objection was that it had too much salt in it for the English trade. On the morning of my visit, a buyer tried to empty the butter out of one of the tubs, but could not, and consequently did not buy. All butter packages should be lined with parchment paper or cloth, in order to protect the butter from the wood, and also to facilitate the "stripping" of it.

The British market desires butter with less coloring, less salt, and less water in it than the average butter sent from Canada. In addition, it must be clean and good in the flavor, which is the most important quality.

Mr. Davidson, of Glasgow, had experiments made with different quantities of salt in Australian butter, and found three per cent. (one-half ounce to the pound) about right. Five per cent. be found was too much.

"There is a good demand for tinned butter, wherever it is hot," said Mr. Harrison, of Red Cross Street, Liverpool, who does about fifty per cent. of this trade. The process is the opposite of canning fruit, as the butter must be of extra quality and packed at low temperatures. The apparatus is expensive and great care and cleanliness are required to produce a good article.

Cheese. "Canadian cheese is all right," said nearly all the dealers with whom I talked. One merchant remarked that our spring cheese might have a little more moisture in it, in order to be ready to eat a little more quickly. Some fault was found with the boxing, as many of the boxes are badly broken when they reach English warehouses. The cause for this, in many cases, is rough handling in loading or unloading from the steamer. At Quebec, I noticed that many times the lids and scale-boards flew off the boxes as they were put on the steamer. The lids were returned, but not the scale-boards.

Mr. Davidson was in favor of branding the date of manufacture on cheese. He remarked, "while many times it might be to my advantage not to have the date on the cheese, yet for the sake of honesty and square dealing, I consider it would be better to have the date on the cheese." The effect, in his opinion, would be to lower the price of early cheese and raise the price of Septembers. At present September cheese do not bring their full value, because dealers are aware that large quantities of June and July cheese are stored, awaiting a rise in the markets.

Bacon. For bacon that is mild in flavor, with fat firm, lean parts mellow, and no salt on the outside, there is a good demand. Mr. Tulton, Lancaster Avenue, Manchester, told me that some brands of Canadian bacon were equal to the Danish, while others were so inferior that he could scarcely sell them at all—one lot actually brought him loss of customers, as it was too strong and too salt. There would seem to be room for a good trade in this branch of the dairy business at remunerative prices. The firm of Tulton & Co. recommends the sending of shipments forward regularly and in not too large quantities at a time. Danish bacon is shipped in linen sacks and has the appearance of fresh meat, slightly cured. "See! that is what we want," said Mr. Tulton, pointing to a dray load of Danish bacon, which was being unloaded at his warehouse; and he ripped open one of the sacks to show me how mild and pleasant this class of meat is, which comes in regularly from Danish bacon curing establishments. "Compare that with this," said he, pointing to some hard, salt Canadian, which he had hanging near by, "and you will see why my trade prefers the former."

How these Wants are supplied by some European Dairy Countries.

Dairy Farming. In Scotland, cheese are manufactured chiefly by women in private dairies. The Dairy School at Kilmarnock is doing good work in assisting Scotch farmers to make a better quality of cheese and butter. It was a pleasure to find a Canadian, Mr. Drummond, in charge of the work. The system of cheese-making taught in the school and practiced on these Scotch farms is essentially Canadian.

The pastures of Scotland, and in fact of all northern Europe, where I went, are such as Canadian dairymen may well envy. No doubt this is largely due to climate; but I am satisfied that if a greater variety of grasses and clovers were used in seeding down and more seed to the acre were sown, it would result in an improvement of our pastures. Mr. Wallace, of Auchenbrain, uses the following when seeding to grass: one and a half bushels of perennial rye grass, eight pounds timothy, two pounds tall fescue, two pounds meadow fescue, three pounds meadow foxtail, four pounds perennial red clover, and three pounds white clover per acre. He top-dresses pasture land with bone meal and fine barnyard manure. In North Holland, where I saw perhaps the best pastures, the farmers also top-dress grass land as often as possible. The grass is natural, and much of the land is never plowed.

In Denmark and Sweden, the farming resembles that of Ontario in many ways; but these and other European countries are very much behind in machinery and rapid methods of doing work. Here one sees the cradle still in use for cutting the harvest. In one field I saw fifteen cradlers at work. Very few reapers are used.

The rotation on Lenchenfeld farm, near Kallandborg, in Denmark, is: (1) bare fallow, (2) wheat, (3) barley, (4) mangels and potatoes, (5) barley, (6) oats, (7) hay, (8) pasture.

On the islands of Jersey and Guernsey, where the most intensive farming is followed —as is found necessary in order to pay the high rents (£5 to £10—$25 to $50 per acre yearly)—they grow two or three crops on the land each year. The first crop is potatoes, and the second (in the same year) is roots, parsnips, or barley. Three crops of hay are quite common. Lucerne clover is largely sown for pasture and soiling crops. All liquid manure is gathered in tanks and sprinkled on the grass land at proper times. A great deal of guano and other artificial fertilizers is used. The average size of a farm is fifteen to twenty acres; but on such a farm a great deal of stock is kept. The farm of Mr. Bell, at La Rocque, Jersey, consists of thirty-two acres, on which he kept the following at the time of my visit: three horses, sixteen cows, sixteen heifers and calves, two bulls and thirty-six pigs. He buys no feed except some bran and dairy cake. He and his son manage the farm, but they keep five men all the year round and have extra help in the potato season. On this farm I saw the two first-prize cows in the butter test at the Royal Agricultural Fair, in the spring of 1895. One of these cows made three pounds four and a half ounces of butter in twenty-four hours on the fair grounds, and the other made three pounds in the same time.

The rotation on this farm is somewhat as follows: Grass is grown so long as it is good. Then the land is plowed and potatoes are planted, which are followed by mangels, carrots or parsnips. Next year wheat is sown, and the land is seeded down after harvest. Sometimes roots are grown two years in succession by changing the places. Thus a field might be in three strips, with mangolds in one, carrots in another, and parsnips in another; and by sowing mangolds on the carrot ground of the previous year, and changing them in this way, roots are grown two years in succession.

Dairy Cattle. I made it a point to visit the homes and some of the best herds of the four leading dairy breeds of Ontario, viz., Ayrshire, Holstein, Jersey and Guernsey.

The Ayrshires. A leading breeder of Ayrshires informed me that many Canadians and Americans are making a mistake in importing yearling and two-year-old prize winners, as the animals are almost always a failure as milkers. So much is the showring injuring the milking qualities of the Ayrshire, that he maintained that there are two distinct breeds (types) of the Ayrshire—one for showing purposes and one for producing milk in paying quantities. The light color with patches or spots of red is the common color, though many are dark, and some a dark red with white spots. Whether in the valley, on the gentle slopes, or climbing the steep hillsides of Ayrshire, the native cow, with medium-sized body, agile step, and square, good-sized udder, if properly bred and fed, is essentially a dairy animal. Breeders are endeavoring to remedy the defect of short teats.

The Holstein. The Holstein at home has abundance of grass in summer time. She remains in the stable for six months and in the fields for six months of the year. During summer her drink is the water of the Zuyder Zee (salt), mixed with the rainwater that falls on the fields—the two kinds of water being confined in ditches, whence the mixture is dipped into wooden tubs for the cattle.

I saw a few Holsteins red and white in color, though black and white is more common. At the Edam fair there seemed to be a tendency to the "beef form" in many of the cows, and they lacked the large udders which are characteristic of the best of these cattle in Canada. Prizes were given for fat cows and fat steers. This I judge a mistake in any dairy breed.

The Jersey. The home of the Jersey is a beautiful place in summer. The excellent roads, arched over by ivy-twined elms, the well kept farms, the flowers and the fruit in profusion, and the creamy cows tethered in the fields, or grazing at will in the walled-in pasture, or else roaming over the rocky hills and sandy shore of the north-west coast, make a pleasant picture for the travellér as he rides along on the paragon car, in the lumbering bus, or on the steam track, that has a wooden gate across it at every level road crossing, to prevent harm to foot or wagon travellers, which gate the station agent runs down to open

for the train to pass through every half hour. Both French and English are spoken ; and most of the names smack of the French, though the people are very loyal to Great Britain. I was told that you cannot insult a Jerseyman more than by calling him a Frenchman.

In size, the Jersey at home is not quite so large as her progeny in America ; but her udder is better developed and her bone finer, as a rule. There appears to be nothing superfluous about her. She is an almost perfect machine for turning feed into rich milk. The light, creamy color seems to be the favorite among the cows, though some have patches of light color, and a few are dark—almost black. The bulls are chiefly dark colored on the sides and joints, with squirrel-colored top and under side. A few are yellow.

In addition to seeing some of the best Jerseys on the farms, I was fortunate in being on the island at the date of the autumn fair of the Royal Agricultural Society, when the best cattle on the island, including cows, bulls, heifers and calves, were on exhibition.

The Guernsey. The island of Guernsey is not so large, nor so well cultivated, as Jersey. The farmers are embarking largely in glass-house fruit culture, and dairy farming is not carried on so extensively as formerly. Butter is imported from Jersey. The herds of Messrs. De Garis and Le Prevost, in Bastel Parish, have captured most of the Queen's prizes since their inauguration in 1889. While driving to these places from St. Peter's Port, the chief town, I saw some cows that were almost black and white in color and a few of a brindle shade. The dark color is not liked, and Mr. Le Prevost offers one pound ($5) for every black hair found on the cattle of his herd. The fawn and white, light red and white, or light red, are the favorite colors.

These cattle are large and handsome, with large udders and well-developed milk veins, and have every appearance of being healthy and good milkers. The bulls are kept in the stable, and the cows are tethered in the field, where the best milkers are milked three times a day. I have not seen in Canada such representatives of the Guernsey breed as may be seen on these farms.

Danish and Swedish Cattle.

There are two breeds of dairy cattle in Denmark, the Red Danish and the Jutland breed. The former are considered best for the dairy ; but of those I saw there is nothing particular to note. Their records are nothing extraordinary, and it is doubtful if their dairy qualities are equal to those of the four breeds mentioned above. The cows are mostly tethered in the field, though some practice herding. One man and a boy herd as many as 130 cows, except in harvest, when an extra boy is needed. Milking three times a day, and usually in the field, is quite common.

In Southern Sweden the Holstein is the dairy cow. A few Ayrshires and Jerseys are also found in the dairy herds. In the Station dairy herd at Alnapp, which consists of 200 cows, there were a number of Shorthorns in addition to those mentioned.

Methods of Breeding, Feeding and Caring for Cattle and Swine.

Breeding. Ayrshires, Holsteins and Guernseys are bred to drop their first calves at from two and a half to three years old—Jerseys at about two years or under. Cows are usually dry one or two months in the year. Calves are raised on skim-milk, meal and hay, or pasture, after having been fed for two or three weeks on whole milk. In Jersey and Guernsey in-breeding is quite common. One Guernsey breeder adopts the plan of going to the opposite side of the island when he desires to introduce fresh blood into his herd, while his neighbor in the same parish keeps three or four families on his farm and does not use any blood outside of these. Both have excellent stock. The effect of breeding young, on size, is seen in the Jersey, the smallest of the four dairy breeds. When the heifers do not drop their first calves until they are two and a half to three years of age the breeds are larger.

Feeding. During summer the main dependence of European dairies for feed is grass. In Jersey the farmers buy "grass mixtures" from reliable seedsmen ; and this plan has given good results. Instead of cutting the green feed and carrying it to the stable, the cows

do their own mowing and carrying. I saw cows tethered in lucerne clover from two to three feet high, and when a circle of fifteen to twenty feet was mown they were moved to a new plot. With cows accustomed to the rope and pin, the labor of moving them twice a day is less than that of cutting and carting the feed to the stable ; and the waste is no greater. Most farmers tether with a light chain fastened about the horns, to which is attached a long rope by means of a swivel. This prevents twisting, and the chain does not shrink with the wet like a rope. A few feed grain, bran or oilcake in summer ; but this is not common.

The winter ration in Scotland is hay and bean meal. Cows drink at a trough outside. Mr. Van Wiltenburg, in North Holland, feeds four pounds of oilcake to each cow daily in winter, and as much hay as she will eat. Water is supplied in the stable, and cows do not go out at all during the winter. Strings from the ceiling, with a piece of leather attached to the tail in such a way as to keep the cows' tails out of the dirt in the gutter, seemed like a good device for keeping cows clean.

Mr. P. Holm, in Denmark, feeds hay, mangolds, cotton cake and oats in winter, while a Jersey winter ration is composed of hay, roots, meal and dairy cake (a mixture of various oil-cakes and concentrated foods bought from dealers).

Most of the stables I saw were built of stone, having stone floors with a drop behind the cows, and mangers made of hollowed stone. Some stables had no mangers whatever. Cattle were fed on the floor where they stood. The location and arrangement of the stables appear to be such that as little land as possible is used to hold them, and for this reason the sanitary adjustments are not the best, as in some cases the owner steps from bed into the kitchen and from the kitchen into the stable. In many places one roof covers stable and the house. This may be all right where the stables are kept extra clean, such as some I saw that were scrubbed out every day. In one place in Holland, carpets were laid on the floor of the stable and lace curtains were on the windows ; but on some farms the house was too near the stable for good health. In Scotland, the cows are usually milked in the stable. In one stable I saw the "Murchland" milking machine in use ; and in another, the "Thistle." Both appeared to be satisfying the farmers, as they saved time and labor, especially experienced help, such as is necessary for hand-milking. Stables are usually whitewashed. All liquid manure is saved for grass land.

Swine. Some things which have no doubt gained for Danish bacon its good reputation, are :

1. The pigs (chiefly Yorkshire grades) are long and lean when sold to the slaughter establishments, where they are graded into Nos. 1 and 2. No. 1 hogs are long and lean, and weigh from 170 to 180 pounds. Many of the slaughter houses are co-operative—owned and managed by farmers.

2. The swine are fed on lean-producing foods, and foods which give a mellow, lean, and firm fat. Green-cut clover, mixed with meal for twenty four hours before feeding, is a common ration in summer. When the pigs are young they receive a greater proportion of cut clover, and as they increase in size the proportion of meal is increased. This, together with skim-milk, is the bacon food of Denmark. Sows raise five litters in two years. They are given plenty of exercise to keep them strong and vigorous. Pigs are weaned at six to eight weeks of age.

In the Channel Islands, Jersey Kale, a plant peculiar to these islands and to the north of France, is the green food of pigs. This Kale or cabbage grows to a large height (eighteen feet sometimes, though five or six feet is more common), and the stem is covered with large leaves which may be plucked several times during the year. At the time of my visit in August, I saw a patch that had been plucked four times this year, and still had a heavy crop of leaves, which would give three or four more pickings before December, when the plants go to seed and all the straight stalks are sold to dealers who make walking sticks of them.

Scotch hogs are imported from Ireland as "stores" and fattened on whey and meal.

While it is the farmer's duty to furnish the right kind of pig, properly fed, of the right weight, it is the duty of the bacon curers to prepare these hogs in the very best manner for market.

Manufacturing Cheese and Butter.

Cheese-making. As already stated, we have little to learn from Europeans as to methods of making Cheddar cheese; but in the matter of cleanliness, tidiness and careful handling of the milk, so as to prevent bad flavors, we might learn a few things.

In "fancy" cheese-making, we have nearly everything to learn. I see no reason why we cannot produce nearly all the fancy cheese that is now imported. In the vicinity of Guelph, Stiltons are now made, which nearly, if not quite, equal the best English make. The Edam and Gouda might also be made in private dairies. The following is an outline of Edam cheese-making as practised on a Dutch farm:

The cows are milked at 3.30 morning and evening, and the fresh, warm milk is put at once (twice a day) into a tin-lined tub, holding about 200 quarts of milk. Two teaspoonsful of rennet are added, and when the milk is thickened, it is cut fine with a wire breaker and the whey run off. The curd is then put into the moulds by hand and afterwards pressed for three hours in a press which gives continuous pressure. The cheese are then placed in the salting mould, and dry salt rubbed on the outside for three days. Then they are put into brine for one day, and next put on the shelves to cure. These shelves have hollow, round places for the cheese, which helps to mould them into the ball shape peculiar to Edams. Some are dipped in purple coloring matter. They are ready to ship in two or three weeks and weigh three or four pounds each. As cheese is made only in the summer months, when the cows are on grass, the stable is frequently the curing room.

Butter-making. I shall not mention the details as practiced in each country, because they are very similar to our own in many things, but simply point out the characteristics of the Channel Islands and Danish methods.

In the former places, the small shallow pan, and old fashioned earthenware crocks and pans are still in common use for creaming milk. Some few have separators. The cream is not cooled after skimming, as cold water is scarce and ice is expensive. Hence butter is often very soft in hot weather. The cream is ripened and churned in barrel churns twice a week. In hot weather the cream becomes very sour; but this is remedied by repeated washings, which remove much of the acid and curd. For the English markets, little or no salt is used. The butter is worked with a hand roller-worker and made up by hand into round pound, and half-pound, prints. Each print of butter is required to have the name of the maker stamped on it. For local trade, each print is sent to market on a cabbage leaf. This butter sells for one shilling and sixpence to two shillings per pound (36 to 48 cents).

In Denmark, the creameries are largely supplanting private dairies. Most of the former are co-operative—owned and managed by the farmers. The company usually hires a "manager," who is responsible for the business, and for the quality of butter produced. So far as I can judge the reputation of Danish butter is due to:

1. The good quality (flavor, etc.) of the milk used in making the butter.

2. The almost universal use of the cream separator.

3. The pasteurising of the cream and the use of cultures in many of the creameries and dairies. Cultures are bought from dealers and added to sterilized milk. Some keep two sets of starts or fermenters on hand all the time so that if one goes wrong the other is likely to be all right. From five to fifteen per cent. of the starter is added to the cream sixteen to twenty hours before churning.

4. Little or no washing of the butter, as but a small quantity of water is added to the butter when it "breaks," and after further churning it is dipped out of the buttermilk by means of hair sieves.

5. The use of a small percentage of salt (three) which suits the English taste.

6. The removal of the excess of moisture by working two or three times. This result, I judge, might be better attained by using a centrifugal butter dryer, such as I saw in England.

7. The use of a package lined with paper, and of a style which suits the British market.

8. The shipment of the butter to market as soon as possible after it is made—once a week on the average; and there is now an agitation in favor of shipping twice a week. Provision is not made in the creameries for storing any quantity of butter.

9. The intelligent use made of the instruction and help furnished to dairymen by the Government through the dairy instructors, and the work done by the Royal Agricultural Experiment Station, especially the chemical department. I shall refer to this work more in particular.

Butter Exhibitions at the Experiment Station.

Six years ago the chemical division of the Royal Experiment Station at Copenhagen, began what are known as dairy exhibitions. The chief cause for these was the fact that in England the cry was raised that Danish butter was adulterated with water. Another cause was, that many of the wholesalers of butter complained of the large loss in weight through leakage of brine and recouped themselves by demanding extra weight of butter in the packages. To settle the question as to what percentage of water is contained in Danish butter, to see what is the actual loss in leakage of brine, and to get the criticism of expert judges, these exhibitions were started and have resulted in much good to the butter industry of the country.

Some of the chief facts gleaned on these and other points, I obtained through the kindness of Dr. Emil Holm, one of the chemists at the station. I submit them for the benefit of Canadian butter-makers.

About twenty exhibitions are held each year and from eighty to ninety samples are collected for each. The manner of securing samples is as follows: The station has a map of the country, with all the creameries and dairies located, which agree to send in samples of the butter on hand whenever requested. About one-half of the creameries and large dairies co-operate in this work. Dr. Holm informed me that they could call in 600 in two days if necessary. When a wholesaler gets a lot of butter from a creamery or dairy that is not first-class, the fact is reported to the laboratory, and a day or two before it is intended to hold an exhibition, all such, and perhaps others, are telegraphed to send a sample of the butter on hand, which is done as a matter of honor. (This butter is bought by the Government, and when the judging and experimenting is completed it is sold. The yearly appropriation for this work is 30,000 kroners—about $7,500.)

On arrival at the station properly marked, so that the owners are known to the chemists, the casks of butter are placed in cold rooms and a numbered can put over each so that the judges know the samples by numbers only.

Under each cask is a pan so arranged that it catches all the brine that leaks from the butter, and this is carefully weighed. On the day appointed, the samples are divided into three separate rooms, and three sets of judges (three men in each set) with corn slippers on their feet, and the ability to tell good butter by smelling, examine each cask of butter carefully and give a written report to the laboratory. Thus, three separate reports are obtained of each cask of butter, which reports are sent to the owners the evening of the day on which they are judged. Samples are also taken from each tub to determine the amount of moisture, and the result of this is also forwarded to the dairymen owning the butter. Samples from the poorest dairies will be asked for at the next exhibition. As a result of this, and of the work done by the instructors who are sent wherever needed, but especially to the dairies and creameries producing the poorest butter, the quality of the butter has been known to improve about seventy five per cent. in one month, or from one exhibition to another. This is the kind of work that tells for improvement in any article of manufacture.

The average percentage of moisture is seen in the table :

In 1891	Danish butter	contained	14.57	per cent.	water.
In 1892	"	"	14.57	"	"
In 1893	"	"	14.24	"	"
In 1894	"	"	13.83	"	"

The average percentage of moisture has decreased nearly three-quarters of one per cent. in four years. The average percentage of moisture found in 4,458 samples during the past five years is 14.32. Two samples contained from 9 to 9-9 per cent.; 1,250 samples ranged from 14 to 14.9 per cent., and eight samples had from 19 to 19.9 per cent. of water. There were others ranging between the maximum and minimum, but these I have omitted to save space. The chemist informed me that the average percentage of water in Danish butter is decreasing all the time. This is being done to meet the demand for butter containing less water. In England it is talked of branding all butter with more than sixteen per cent. of water in it as adulterated. The English consumer realises that water at one shilling a pound is rather expensive.

In former years the winter butter contained much more water than the summer make, and also leaked more brine. Now, there is not so much difference. Six years ago, out of 1,419 casks of summer butter examined, 140, or ten per cent. leaked. Of winter butter, 362 casks (twenty per cent.) leaked, out of 1,751 tested. The table shows the decrease by years :

Year.	Per cent. that leaked.		Average of both.
	Summer.	Winter.	
	Per cent.	Per cent.	Per cent.
1890-91	13	48	36
1891-92	10	42	24
1892-93	9	24	17
1893-94	8	24	19
1894-95	12	14	13

It was found that the amount of brine which leaked from the casks did not depend so much upon the water content as upon the quality of the butter—the better the quality, the less the leakage.

The loss of weight in summer by evaporation, in only seven days, was twenty-seven kirnt (about one-quarter of a pound), and the total loss by evaporation and leakage in summer was seventy-three kirnt (about three-quarters of a pound) per 112 pounds. The winter loss was respectively eighteen and fifty-six (one-sixth and one half pound) kirnt. One hundred kirnt equals one Danish pound, which is about ten per cent. heavier than an English pound.) The station found that the average loss in weight was greater by evaporation than by leakage and that the amount was no greater from butter containing a light percentage of water than from butter with a low percentage of moisture.

Having stated that pasteurising cream (heating to 160 degrees F.) is probably one of the causes of the good quality of Danish butter, I will give a few facts under this head. In 1893, six per cent. of the samples was from pasteurised cream ; in 1894, ten per cent., and in 1895. twenty-eight per cent. of the exhibition butter was made from cream treated in this way. During the past three years it has been found that the average score of butter made from pasteurized cream has been one point higher, and the butter has contained over half of one per cent. less moisture than the samples which have been made from cream not so treated.

Milk Supply for Cities.

In London, England, the Aylesbury Dairy Co. is one of the largest concerns of the kind in the world. They have beautiful premises at St. Petersburg Place; but a call there resulted in my gaining the information that, "it is strictly against the rules to allow strangers in the place without an order from the president" (who was away for six months and I could not await his return), "or from the secretary," who was also out of town indefinitely. I had the privilege, however, of seeing two large men in blue clothes, yards of braid, and brass buttons, whose duties appeared to be to see that no one should enter the door or climb up any other way, without a permit. Two ladies in the office seemed to be also under their protecting care.

The Milk Supply Co. of Copenhagen was more courteous; and I am under obligation to Dr. Borsh, the president, and his good Scotch lady, who very kindly showed me over the premises and explained the workings at an hour when they would probably have otherwise been resting at home, as from nine to eleven or twelve o'clock at night is the best time to see the work go on.

This is a model institution and no other city in the world has the same care exercised over its milk supply. Some, or all of its features might well be copied by Canadian cities. A full description would take too much time and space, besides it has been fully writen up in several pamphlets which may be easily obtained. I shall mention but a few of its leading features.

1. All herds of cows supplying milk to the company are under the strict supervision of veterinary surgeons, and no unhealthy cow's milk is sent to the city. If an animal becomes sick from any cause, the milk is paid for as usual until she becomes better or is taken from the herd, thus there is no temptation to dodge the rules. If contagious disease breaks out in the family, no exposed person is allowed to come near the milk; and, if a serious case occurs, the milk is not sent, but paid for as usual, if the party complies with the regulations as to notifying the company.

2. The feeding and management of the cows is so regulated by written contract and overlooked by expert dairymaids, that it is difficult for a bad taste or taint to get into the milk. The following foods are prohibited: "Brewers' grains, and all similar refuse from distilleries, turnips, rutabagas and tops. Oilcake, carrots, sugar beets, and mangels are permitted, up to one-half bushel per cow, but only when at least seven pounds of corn, bran, or cake are given along with them. Cows supplying infants' milk may get carrots, but never more than one quarter bushel per head. Rape seedcake is the only oil-cake which may be used; one and one-half pounds is the furthest limit of this, along with at least five pounds of meal and bran. Infant milk cows must not receive any cake. Stall feeding in summer is not permitted. The cows must be fed in the open air, upon clover and grass. Vetches are forbidden. In autumn, the cows have to be clipped on the udder, tail, and hind quarters before being taken in. The milk of cows newly calved must be withheld for twelve days after calving and must not be less than three quarts per day."

The above are only a few of the rules in reference to care and feeding.

3. Great cleanliness is exacted during milking. The milk must be strained through a wire sieve, covered with a clean woolen cloth. Immediately after milking, and during all seasons of the year, the milk must be cooled down with ice water to forty degrees Fahrenheit. Thirty pounds of ice must be kept in stock for every 100 pounds of milk produced.

4. On arrival at Copenhagen (about nine p.m.) the milk is weighed and sampled for testing. Expert tasters (women) examine each can, and if anything is found wrong, the party is notified by wire in the morning.

5. All milk is filtered through sand filters, which remove all impurities. A specialty is made of milk for infants. This milk is bottled and sealed, that persons may know that it is pure. Pasteurised milk, cream of two grades, and skim-milk containing about one per cent. of fat, are also sold. Very poor people are given milk free, as the object of the company is to supply pure milk to the people, and not to make money.

6. Surplus milk is made into butter, which is packed in earthenware jars and sold at a moderate price.

7. All bottles, cans, filters, etc., are sterilized with live steam after each using. The most perfect order, discipline and cleanliness prevails. Women in white dresses, caps and aprons, do the bottling.

8. The city is divided into forty districts, and each district has a van for distributing the milk. Some hand vans stand on the street, and people come for their supplies. In addition, the company has eight hospital vans for carrying milk to public institutions.

Lessons for Canadian Dairymen.

1. We should endeavor to lessen the effects of summer drouths by providing better pasture and more soiling crops. This may be done by using more seed, and a greater variety, especially of deep-rooted plants, such as lucerne. This, with pease and oats, corn, bran, and some cake would increase the returns from our cows.

2. More labor wisely directed, would enable us to grow two crops each year on some land, and in some portions of the Province. This would mean the use of a greater depth of soil and of more fertilizing material. The Jersey farmer plows twelve to fourteen inches deep, and uses large quantities of sea-weed and artificial manures, in addition to all the farmyard manure obtainable.

3. The wants of the markets of the world should be more closely studied, not forgetting the home markets. Endeavor to supply these in the very best manner possible and in the cheapest way, consistent with good quality.

4. At the present time Canadian cheese has a good reputation in the British markets, but continued care and improved quality are necessary to enable us to hold our place, as competition is very keen and it is becoming more difficult each year to sell goods of inferior quality.

The practice of storing cheese in ice-houses will eventually (if it is not doing so now) hurt our cheese trade. There are few cheese that reach the consumer across the ocean too green, and the storing of early cheese results in their becoming over-ripe in many cases. There is less demand each year for strong dairy products. They must be mild in flavor.

5. The best Canadian butter when first made is as good as any butter produced in Europe (with the possible exception of salt and color for British taste), and the problem we have to solve is, *to have all our butter equal to the best and to get it on the market within two or three weeks after is is made.*

6. The best Canadian bacon is equal to anything offered in the market, and by paying attention to the breeding and feeding of hogs, and by brushing up some of our curers, we may have our full share of the bacon trade.

7. Our *best* dairying cattle, stables, utensils, and methods of manufacturing are equal or superior to those in European dairies, with, perhaps, a few exceptions noted. Canadian dairymen, as a class, considering their opportunities and experience, are the equals or superiors of dairymen in the Old Land. We need not be discouraged, as we are on the right track and bound to win our share of the world's trade in eatables. European dairymen are becoming alarmed at the quantity and quality of dairy products sent from the British colonies, and as a consequence are somewhat reluctant to let us into any secrets of the trade which they may possess. We, on the other hand, give our knowledge freely to the world.

Suggestions.

1. We need some distinctly *Canadian packages* for our first-class dairy products. All that there is in a name, is associated with the package in the eyes of a Britisher. If we had a cheese box or style of cheese different from that of any other country in the world, it would result in a higher price for our cheese. The same is true of a package for

butter or a method of marketing bacon, provided the quality is extra in all cases. At present, little or no distinction is made between Canadian and American goods. Our cheese is made in the same style and marketed in the same kind of a box, while our butter is shipped in tubs, casks, square boxes, etc., which is probably well at present, but which would not do for a country producing a really fine article. We are slavish imitators in the matter of packages, and I would suggest a handsome prize for the best original Canadian cheese, butter and bacon packages, and that if found suitable, we adopt them for our export trade. It would be ahead of brands, which are very easily removed, and, besides, it would strike the eye of the purchaser without requiring him to hunt up a mark.

2. There is room for the development of dairy trade in the following branches :

(*a*) In tinned butter, for export to warm countries and for use on board ships.

(*b*) In the cold process of condensing milk, and the freezing of milk, for ship use in summer.

(*c*) In the manufacture of fancy cheese for home markets.

(*d*) In the supplying of Cheddar cheese to countries where it is little known, or where butter is made a specialty and fancy cheese are imported at a high price.

3. Pressure might be brought to bear on the Imperial Government to prohibit or restrict the sale of margarine and all butter imitations, "filled" cheese, and such like, wh ch would open up a market for large quantities of pure cow products, that is now glutted with vile imitations. A dealer in Glasgow assured me that if the Colonial Governments would act in this matter, in his opinion, it would result in the prevention of the sale of this cheap stuff which nobody wants, but which is thrust before the people on every hand.

4. Something in the nature of "dairy exhibitions" of both cheese and butter might be profitably undertaken. To some central point or points, samples of goods might be forwarded from our cheese factories and creameries, where they could be judged by experts and the results sent to the owners. This done once a month would result in much good. Samples might also be taken for chemical analysis and the proportion of the most important constituents determined. At present, we do not know the percentage composition of Canadian cheese and butter.

In addition, the system of instruction in our creameries might be perfected. It is impossible for one man to give proper instruction to all the creameries in Ontario.

With the hope that the foregoing may be of benefit to Ontario farmers and dairymen, this brief report is respectfully submitted.

VI. MISCELLANEOUS DAIRY NOTES AND EXPERIMENTS.

Meetings Attended in 1895.

In addition to my work at the College, I have attended meetings and given addresses at the following places: Gananoque (Eastern Dairymen's Association), Kingston, Chesley (Creameries' Association), Stratford (Western Dairymen's Association), St. Thomas, Simcoe and Kincardine (branch meetings of Western Dairymen's Association), New Dundee, Cheltenham, Tottenham, Glen Huron, Erin, Mount Forest, Fergus, Elora, Freelton, Listowel, Millbank, Shakespeare, Rockwood, Campbellville, Arkell, Brockville, Sandwich South, Sarnia, Alvinston and Beachburg. These places cover a good portion of the Province, located, as they are, some in the extreme west and some in the east, and comprising the counties of Renfrew, Leeds, Frontenac, Peel, Simcoe, Halton, Wellington, Waterloo, Perth, Bruce, Elgin, Norfolk, Essex, and Lambton.

The superintendent of Farmers' Institutes also arranged a series of Farmers' Institute meetings, which I attended in December, at the following places: Perth, Smith's Falls, Merrickville, North Gower, Manotick, Metcalfe, Almonte, Pakenham, Renfrew, Cobden, Westmeath, Stella, and Emerald, comprising the counties of Lanark, Grenville, Carleton, Russell, Renfrew and Amherst Island. These make altogether some forty meetings which I have attended during the year.

Souring Cream with Acids.

During the month of May, three experiments were made with hydrochloric acid added to sweet cream. At each trial, a sample of the sweet cream was churned at the same time. The first experiment was made by adding one c.c. of hydrochloric acid to eight ounces of sweet cream, which was churned in a quart bottle in the oil-test churn. Both the acid cream and the sweet cream churned in thirty-five minutes. The second trial was made by heating the cream to one hundred and fifty degrees F. for ten minutes and then cooling it to fifty degrees F. Two c.c. of hydrochloric acid were added and the butter came in twenty-three minutes, while the sweet cream, without acid required twenty-five minutes for churning. To a third sample of the same kind of cream (*i e.*, cream that has been heated and cooled) was added five c.c. of vinegar, and the sample churned in twenty minutes. At the third trial, three c.c. of the acid were added to one sample, and ten c.c. of vinegar to another, and a third sample was churned sweet. The hydrochloric acid sample churned in ten minutes, the vinegar sample in seventeen minutes, and the sweet cream from the separator in twelve minutes.

All the butter made from cream to which hydrochloric acid had been added, had a smell resembling that of rotten eggs. The vinegar samples had a vinegar flavor. There would seem to be nothing in the addition of these acids to cream to aid in the production of good butter.

Low Percentages of Fat in the Milk of 1895.

From many parts of Ontario, come complaints that the milk has been testing very low in fat during the past season. We have had several cans of milk in our own dairy that have also tested very low. We had ten cans that tested below three per cent. during August, September and October. One sample went as low as 2.3 per cent. of fat, with a lactometer reading of 29.5 and 7.95 per cent. of solids not fat. Others ranged from 2.4 to 2.9 per cent. of fat and 8.1 to 8.65 per cent. of solids not fat.

This shows the possibility of milk, as it comes from the cow, testing below three per cent. of fat and below 8.5 per cent. of solids not fat, and emphasizes the fact that inspectors and others who prosecute patrons for watering and skimming milk, should, as a rule, make some sort of test, before entering an action against a person for tampering with his milk. The simple fact of the milk testing low one morning at the factory, is not, to my mind, evidence sufficient to establish guilt. A sample should be taken night and morning, from the suspected cow's milk, after the suspicious test has been made. This compared with the sample or samples tested at the factory, is far more satisfactory to my mind and lessens the danger of throwing suspicion on innocent persons.

Loss of Milk in Weight from Standing Over Night in Cans.

A patron of a cheese factory propounded the question as to what loss in weight occurred from allowing milk to stand over night in the cans. We were unable to answer the question; so made a number of tests to ascertain the truth in the matter. These tests (twenty-four in all) were made during the summer. Sometimes the cans were set outside the dairy, sometimes in a cool room in the basement of the dairy building and sometimes in water. The milk was carefully weighed in the evening and again in the morning. Samples for the Babcock tester were also taken from sixteen different cans.

The results showed a shrinkage in weight of from 1,761 pounds to 1,753¾ pounds, that is, seven and a quarter pounds in the whole twenty-four trials. The average percentage of fat in the milk in the evening was 3.675, and in the morning it was 3.653, or practically the same thing, showing that milk will test the same in the morning as it did the previous evening—*if none of the cream has been removed, and the milk has been properly cared for, so that the cream may be thoroughly mixed with the milk again, in order to get a fair sample.*

Whey Butter.

On May 6th, we ran 780 pounds of whey containing 0.2 per cent. fat through the No. 3 Alexandra separator. The temperature for separating was ninety-one degrees to ninety-two degrees, as it was taken as soon as possible after being dipped. It took twenty-five minutes to run it through the first time; but, owing to the fact that the "cream" was so thin (only 2.0 per cent. of fat), we put it through a second time, occupying ten minutes more. Finally we got six pounds of cream, testing 20.1 per cent. of fat. This cream was cooled; the next day it was churned at a temperature of fifty-nine degrees; and the product was found to be one and a quarter pounds of very good butter. In grain and body it was not quite up to the mark, but otherwise it was very fair.

When butter is scarce and dear, it may pay to separate the cream from the whey and churn it; but it would not pay at present prices.

Centrifugal Drying of Curds.

Some experiments were made with a centrifugal curd dryer. We had no special machine for the purpose, but got a tinsmith to make a perforated pan to be attached to a Babcock tester. Our trials did not indicate any special value in the process. In the case of quick-working curds, where it is necessary to get the excess of moisture quickly and thoroughly removed, it might be of advantage to have a machine, something like a clothes dryer, to expel the moisture. It might also assist in retaining an *even* amount of moisture from day to day.

Cheese-curing Room Cool.

In hot weather, there is a great loss of weight in cheese, largely due to the evaporation of moisture; but, in many cases, there is also a loss of butter-fat where the cheese became too warm. A simple device which we used the past season, prevented our curing room from going above seventy degrees F. in the hottest weather; and our room is not so well constructed as it might be, owing to the fact that it is an old building re-modelled. The device was simply a large, open, shallow pan made of galvanized iron, with a hole in one corner. The pan is about three inches deep, three feet wide, and six feet long. This pan was placed on an upper shelf in the curing room and two or three blocks of ice were put in daily. The water was conducted from the hole in the pan, by means of a tin pipe and a piece of hose, to a hole in the floor below. During very hot weather, the ice water was caught in a pail and sprinkled on the floor. This plan is cheap, and with us it worked very satisfactorily. A hygrometer was kept in the curing room, and the moisture was shown to be "normal," or nearly so, during the whole summer.

Rennet Tests for Determining the Ripeness of Milk in Cheddar Cheese-making.

For our work, we use what is known as the dram test with eight ounces of milk at a temperature of eighty-six degrees F. In the hands of a careful person this test gives good results. An improvement might be made, however, by measuring the rennet in a pipette, instead of a dram glass, to get a more accurate quantity. A new rennet test was sent us from Hansen's Laboratory, Little Falls, N.Y., called the Marschall, for trial

this season. This test consists of a graduated cup, with a small opening in the bottom, a one c.c. pipette, a glass in which to dilute the rennet, and a spatula for stirring the milk. In making the test, measure one c.c. of rennet extract with the pipette and empty this into the glass which has been previously filled about half full of pure cold water. Rinse the pipette into the glass and mix the water and rennet well. After stirring the milk well in the vat, which should be a temperature of eighty-six degrees F., fill the cup with milk and place it on a level board, in such a position that the milk will flow freely from the opening at the bottom. Then take the glass of diluted rennet in one hand and the spatula in the other, and when the milk lowers to the o mark, stir in the diluted rennet, and let it stand. When the coagulation is complete, the milk stops running and the graduated scale may be read.

It is claimed for this test that it does not require so much skill to manipulate it as do the others in use, and that the maker is able to tell exactly the point of coagulation. There are good points about the test, but we have the following objections to it:

1. Too much milk is required. True, this milk need not be wasted, but it is likely to be at a factory.

2. It takes too long a time for coagulation. We have found that it takes about a minute for the milk to run down one degree on the scale. If the milk is very sweet and needs a "starter," it requires more time than should be spent in testing. To run down to six, eight or ten on the scale would require that number of minutes. On the other hand, if the milk is working "fast," a loss of two or three minutes in setting may make considerable difference in the quality of cheese, as fast working milk must be handled promptly, so as not to allow the acid to get ahead of the rennet, as cheese-makers say.

3. The scale is not fine enough for accurate results. A smaller cup with a finer scale would seem to me to be an improvement.

We have compared the Marschall with the dram test, and have found the following relations between the two:

Date.	Marschall test.	Dram test.
October 5	4 degrees.	25 seconds.
" 5 (2nd trial)	3 "	20 " (at 87°)
" 12	3¼ "	22 "
" 18	3½ "	21 " (at 87°)

Testing of Apparatus, etc.

During the year, we have received considerable dairy apparatus, brands of rennets, etc., to be tested. This work, we are glad to do, so far as time will allow. On April 27th, we made a trial of the Bartlett aerator and cooler. The average temperature of the milk when put into the cooler was ninety-four degrees. The temperature of 198 pounds of milk direct from the cows, was reduced to seventy-eight degrees by the time the ice in the chamber was all melted. For a small quantity of milk, this cooler and aerator would answer very well.

A steel churn sent for trial did good work and was very neat in appearance; but we found that the butter stuck to the sides rather too much for economy.

A tub lined with paraffine wax seems to possess all the good qualities of a tin-lined tub and is much cheaper. After standing one month with butter in it, no leakage whatever appeared on the outside. Neither was there any disagreeable flavor.

A glass jar package with tin cover was sent here for trial. We did not find the butter keep any better in this package than in the ordinary package, while the risk of breaking, if shipped long distances, would be considerable.

A sample of Fairlamb rennet appeared to be of equal strength with Hansen's and produced good flavored cheese.

Provincial Dairy Show.

The Provincial Dairy Show held at Gananoque, October 1st, 2nd and 3rd, was characterized by the attendance of some of the best dairy stock in Canada. Nearly all the leading breeders were present. It also had this feature, that the cows in the milking classes were judged according to a scale of points adopted by the British Dairy Farmers' Association.

I was asked by the Secretary of the Agriculture and Arts Association to take charge of these tests. Mr. Hutton, one of our second year students, gave me valuable assistance in the work. There were some forty-eight entries for the milking classes, but only twenty-four cows finally entered the list. The breeds were represented by four Jerseys, eight Ayrshires, eight Holsteins, two Guernseys and two grade cows, making a fairly representative lot from each of the dairy breeds.

The cows were milked out clean on the evening of September 30th, and the test commenced at six o'clock the morning of October 1st. It concluded on the morning of October 3rd, making five milkings in all from each cow. The fat was determined by the Babcock tester and the solids by the lactometer, according to a formula used in our dairy school work, which was described in Bulletin No. 93, published last year. The standing of each cow, as determined by the scale, will be found in the table below. I have omitted the result by classes and have placed the cows in their order of merit. Readers will please note that the following are *three year old*, (and this needs to be considered when comparing the cows): Emery Beauty, Lady Heather 2nd, Lady Peterje, White Lillie, Belinda of Eastview and Lady Graceful:

Name of cow.	Breed.	Number of days milking.	Lbs. of milk in 2½ days.	Average per cent. of fat.	Total lbs. fat in 2½ days.	Average per cent. solids not fat.	Total lbs. of solids not fat in 2½ days.
1. Carmen Sylvia	Holstein	33	138.00	2.80	3 827	8.81	12.03
2. Eunice Clay	"	66	103.00	3.13	3.217	8.23	8.44
3. Aaggie Ida	"	59	99.50	3.20	3.226	9.19	9.15
4. Maggie Mitchell	Ayrshire	77	93.25	3.50	3.292	9.14	8.52
5. Lady Dewdrop	Holstein	91	96.75	3.10	2.984	8.44	8.15
6. Oxford Jewel	"	54	96.75	3.06	2.960	8.69	8.40
7. Grade	Grade cow	117	82.25	3.93	3.230	9.06	7.46
8. Josie Lass	Holstein	18	99.25	2.60	2.606	9.44	9.37
9. Nellie Osborne	Ayrshire	18	92.50	2.90	2.704	9.09	8.44
10. *Emery Beauty	Holstein	53	87.75	3.06	2.666	8.82	7.69
11. Jean Armour	Ayrshire	8	82.75	3.30	2.756	9.51	7.85
12. *Lady Heather 2nd	"	51	68.00	3.33	2.247	9 37	6.34
13. Spotted Maid	"	229	59.75	3.46	1.956	9.26	5.52
14. Ada of Eastview	Guernsey	53	59.75	4.33	2.581	9.74	5.81
15. Jess	Grade cow	112	57.25	3.76	2.250	8.95	5.09
16. *White Lillie	Ayrshire	18	62.00	3.63	2.302	9.26	5.77
17. *Lady Peterje	Holstein	190	57.50	3.13	1.807	8.81	5.03
18. Gipsy	Jersey	92	52.75	4.53	2 436	9.41	4.96
19. Rose of Bethal	Ayrshire	46	57.50	4.06	2.323	9.24	5.32
20. *Belinda of Eastview	Guernsey	124	51.50	4.44	2.279	9.84	5.06
21. Satanella	Jersey	16	59.00	4.10	2.358	8.75	5.14
22. Silver Delle	"	50	51.00	4.80	2.412	9.24	4.64
23. Lulu Delle	"	48	45.75	4.86	2.241	9.22	4.22
24. *Lady Graceful	Ayrshire	91	46.00	3.66	1.675	9.37	4.30

*Three year old heifers.

From the data given in the preceding table, we can figure out the points for each cow. Trusting that some more of our dairy exhibitions will award the prizes for milk cows on this or a similar scale, I will give the method of calculating the points for the first cow, *Carmen Sylvia*. Our scale allows one point for each pound of milk; therefore, this cow is credited with 138 points for milk. For each pound of fat, twenty points are allowed; therefore, we credit her with 3.827 pounds of fat × 20=76.54 points. For each pound of solids not fat, she is credited with four points, or 12.03 × 4=48.12 points. For each ten days in milk after the first twenty days (limit 200 days), she is credited with one point, or 33 – 20=13, and 13÷10=1.3 points for days milking. Our scale further states that for each per cent. of fat below three, ten points are to be deducted; therefore, as her average percentage of fat was 2.8, we must deduct two points from her total score, which makes her final score as follows:

	Points.
Points for milk	138.00
" " fat	76 54
" " solids not fat	48.12
" " days milking	1.30
Total	263.96
Points deducted	2 00
Final score	261.96

To show that cows in different periods of lactation are placed on a more even footing than with any other scale that I have seen, and that nearly all points of value are included in the scale, I append the scoring of each cow:

Name of cow.	Points for milk.	Points for fat.	Points for solids not fat.	Points for days milking.	Total score.	Points deducted.	Final score.
1. Carmen Sylvia	138.00	76.54	48.12	1.30	263.96	2.00	261.96
2. Eunice Clay	103.00	64.34	33.76	4.60	205.70	.....	205.70
3. Aaggie Ida	99.50	64.52	36.60	3.90	204.52	.....	204.52
4. Maggie Mitchell	93.25	65.84	34.08	5.70	198.87	.....	198.87
5. Lady Dewdrop	96.75	59.68	32.61	7.10	196.14	.....	196.14
6. Oxford Jewel	96.75	59.20	33.60	3 40	192.95	.....	192.95
7. Grade	82 25	64.60	29.85	9.70	186.40	.....	186.40
8. Josie Lass	99 25	52.12	37.46	.....	188.83	4.00	184.83
9. Nellie Osborne	92.50	54.08	33.78	.....	180.36	1.00	179.36
10. *Emery Beauty	87.75	53.32	30.76	3.30	175.13	.....	175.13
11. Jean Armour	82.75	55.12	31.40	.....	169.27	.....	169.27
12. *Lady Heather 2nd	68.00	44.94	25.36	3.10	141.40	.....	141.40
13. Spotted Maid	59.75	39.12	22.10	18.00	138 97	.....	138.97
14. Ada of Eastview	59.75	51.62	23.24	3.30	137.91	.....	137.91
15. Jess	57.25	45.00	20.36	9.20	131.81	.....	131.81
16. *White Lillie	62.00	46.04	23.09	.....	131.13	.....	131.13
17. *Lady Peterje	57.50	36.14	20.10	17.00	130.74	.....	130.74
18. Gipsy	52.75	48.72	19.83	7.20	128.50	.....	128.50
19. Rose of Bethal	57.50	46.46	21.26	2.60	127.82	.....	127.82
20. *Belinda of Eastview	51.50	45.58	20.25	10.40	127.73	.....	127 73
21. Satanella	59.00	47.16	20.56	.....	126.72	.....	126.72
22. Silver Delle	51.00	48.24	18.57	3.00	120.81	.....	120.81
23. Lulu Delle	45.75	44.82	16.88	2.80	110.25	.....	110.25
24. *Lady Graceful	46.00	33.50	17.20	7.10	103.80	.....	103.80

Milking Machines.

Considerable interest has been manifested during the past year in machines for milking cows. An article clipped from a paper puts forth their importance in the following manner:

A writer in the *Agricultural Gazette*, England, makes the point that the number of cows that can be kept are now limited by the number of milkers that can be provided, and that this fact has operated to restrict the amount of butter and milk products that are placed upon the markets. The milking machine would change all this, and do for the dairy interests what the twine-binder has for the grain markets. The twine-binder multiplied the capacities of wheat sections to put wheat on the market with the result that it has practically destroyed the wheat producing interests of England. He does not find in the impatient waiting of milkmen for the milking machine a cause of commiseration, for should it come it would at once change milk production as it has wheat production. It would enable large farmers, who have been obliged on account of the labor market to maintain small herds of cows, to keep large ones. This would concentrate dairying into the hands of the few, and greatly increase the production of butter. Perhaps we had better use his language, which is as follows:

"That the amount of milk may be doubled, tripled, or multiplied many times if there is a market for it, and that produced abroad will all find its way to this country, with the usual lowering of prices from over-production. There will not be a reduction in the number of workers at all, so that there will be no saving of labor in one sense, for, though the number of milkers will be reduced, the increase in the number of cows will give more other work to balance this, so that few will be thrown out of employment. Now the introduction of the milking machine will make it possible to keep a cow to every three acres throughout the dairy regions of the earth. The man who kept fifty cows on a 300-acre farm could now keep 100 cows, while 200 may be kept to the square mile."

The above writer, who predicts the great change that will result from a successful milking machine, says that we have now two successful milking machines and must face the probabilities of prices going still lower. Leaving out preliminaries we quote the following from this writer:

"Dr. Shiels, of Glasgow, taking up Gray's machine, developed and improved it so much, that after a trial of many months, chiefly at the farm of Mr. Wallace, of Auchenbrain, N.B., (who is known as a winner of cheese-making championships), it is pronounced a perfect success and a company is just launched this week with a capital of £50,000 to make them to supply the world. Murchland's machine has been in constant use by Mr. Speir, near Glasgow, for several years, so that there are now two in the market which the makers are prepared to fit up, and which are guaranteed to give satisfaction. Milking cows by steam (or rather by oil-engine) is now, therefore, an ordinary, practical work-a-day success, and farmers who have a difficulty in procuring milkers can now have the apparatus fitted up at a cost of about 12s. per cow, plus the cost of the engine to drive. Murchland has been advertising his set at £70 for a dairy of forty cows, this price including a small oil-engine as a motor. An article appears from the pen of Mr. Speir in the current volume of the "*Farming World* Year-Book," describing the successful use of the same, and all doubts may now be dispelled as to its efficiency."

The interest in milking machines is very great in the home of the Ayrshire, where "The two most successful machines," originated, and it might be well to quote, a lively discussion on the subject, which occurred a short time since at a meeting of the Glasgow Dairymen's Association. The report is from *The Scottish Farmer*:

The "Thistle" Milking Machine.

On Wednesday evening Mr. Kennedy, South Portland Street, Glasgow, lectured before the members of the Glasgow Dairymen's Association on "The 'Thistle' Milking Machine"—the new invention of Dr. Shiels, of Glasgow, and Mr. Elliot, of Messrs. Lawrie & Symington, Lanark. There was a good attendance of dairymen, and the

audience included a number of farmers and others who are interested in the subject. A small hand-power machine, with all the necessary appliances, was exhibited in the room, and its working was fully explained at the close of the lecture. Dairymen, cowfeeders, farmers, and all others present greatly enjoyed the description given of the machine, and the explanations which followed the lecture were of the highest importance to those present.

Mr. James Stirling, Dunbarton Road, President of the Association, occupied the chair. In introducing Mr. Kennedy, he said they were met to have explained to them the working of the machine they saw before them. Mr. Kennedy had set himself the task of proving that it was going to be a sanitary reformer and a saver of labor—two matters of the utmost importance, not only to them as dairymen, but also to those in whom they were interested. (Applause.)

Mr. Kennedy, who had a most cordial greeting on rising to address the meeting, said it gave him great pleasure to come and tell them about the "Thistle" milking machine. Well, what good would such a machine do? In the first place it would ensure cleanliness, and, this, as they knew, was one of the greatest things they had to look to in their trade. In this connection, and as showing the general utility of the machine, the lecturer quoted from articles and reports in *The Scottish Farmer*. The first of these referred to was the lecture delivered by Mr. Fulton, Shiels Farm, Renfrew, before the members of the Glasgow and West of Scotland Agricultural Discussion Society, and speeches by Mr. Robert Wilson, Manswraes; Mr. John Gilchrist, Orbiston Mains, and others, all of whom testified to the benefit which the "Thistle" milking machine would confer upon dairy farmers. That such a machine was wanted was quite evident, for in the report of the British Dairy Farmers's Association meeting in *The Scottish Farmer* he read that Colonel Curtis Hyward pointed out that the object of the dairy show was to find the best milking machine. The necessity for the machine was undoubtedly admitted. The foreign competition with which they had to contend involved two alternatives. The first of these was to force bigger prices. That was politically impossible. (Hear, hear.) Well, they could cheapen the cost of home production, and the "Thistle" milking machine was a step in the latter direction. There were two classes of machines. The one class was adapted for milking from one to four cows, and was driven by hand power. The power machine would milk from four to twenty cows. All the machines were made on the same principle—viz., the suction produced by vacuum in the teat cup which pressed against the teat of the cow and extracted the milk, which was carried off to a receiving pail. When the teat was drained of its milk air entered the cup, allowing the former pressure to relax, and the teat was again filled with milk from the udder. Vacuum was once more created in the teat-cup, which again collapsed, pressing out the milk into the tube, and it passed then to be received as before. The teat-cup was made of flexible India-rubber, and it was adapted to any cow. There was no difficulty in attaching these, and the four teats were milked simultaneously. In order to know when to stop milking, there was a glass cover on the top of the receiving pail, from which it could be see when the milk ceased to flow. When that was so the cow could be disconnected till the rest were done. What good would the machine do? In the first place the milk would be drawn off clean, and that of itself was a great matter. (Applause). In this connection he would refer them to the lecture delivered by Mr. Campbell to the members of the trade, at the request of their worthy President, Mr. Stirling. In the report which appeared in *The Scottish Farmer* on the 22nd December, 1894, Mr. Campbell said: "Milk could only be defiled by the hands of the milker, by the milk dishes, and by the air. If these were absolutely filth-free there could be no souring." (Applause.) Then about ills brought about by dirty milkers, Mr. R. H. Beamish was reported in *The Scottish Farmer* of the 9th February, page 107, to have spoken strongly at the Dublin Dairy Conference "about preventing contamination of milk by dirty milkers and dirty udders." Once more, as regards the matter of cleanliness, he would remind them of "Golden Rules for Butter-making," by Mr. James Blyth, as published in *The Scottish Farmer* of 16th February at page 128. One word more about cleanliness, and this was in reference to the hands. In Mr. Campbell's speech as reported in *The Scotttsh Farmer*, he said:—"Hands well washed

and disinfected were not clean. Visible dirt there might not be. Had they examined their skin with a magnifier? . . . Only then could they realize how easily these things could lurk in a man's skin; only then could they understand what clean hands really meant." (Hear, hear.) The machine he was describing guarded against all this. (Applause.) The milk, too, was drawn off in less time than by hand. A hand machine milked four cows, and a power machine milked four cows and upwards within ten minutes. The machine seemed, under all the circumstances, to cause less annoyance to the cow than the human hand, and fractious cows with sore teats seemed to suffer less pain when milked by the machine than if a milkmaid had performed the operation. Kicking cows were very easily managed when the machine was used. Indeed, from a test which had been made, they seemed rather to like the machine, because it was more like the calf's mouth. That was stated in a report by Principal M'Call to the patentees which, however, was not yet made public. He would now give them some details regarding the machine, a model of which they saw before them on the table. It was patented by Dr. Shiels and Mr. Elliot, of Lanark, and the principle on which it was based was simplicity itself, being the means of a creation of pulsating vacuum from a storage tank. Mr. Kennedy asked how many dairymaids would be required to milk thirty cows, and what would these cost?

Mr. Semple replied that they would require four women at a cost of £80 per annum.

Mr. Kennedy said that a hand machine for four cows, with a woman and a lad, was capable of milking thirty cows in less time than four women could do it. It cost £45, and this was a saving of labor of about £40, so that the price of the machine was almost realized the first year. In that way they would see that the machine would be a great saving. He did not think he could get four dairymaids at £80, but they would take it at that. And then there was the necessity for milking all cows regularly at the same hour, which could be guaranteed by the use of the machine. Putting all these advantages together, this seemed to him an investment by which any dairy farmer could save one hundred per cent. per year. Mr. Kennedy then went on to explain the construction of the machine and how it was wrought. The vacuum once created, sufficient power was instantly obtained to commence milking, for which no preparations were necessary, but to place the milking pails under the cows, put the cups on the teats, and connect with the exhaust tube—all the work of a few seconds. The exhaustion was, of course, effected by means of an air pump, which could be worked by the motive power if convenient. In connection with the actual milking the teat cup was by far the most important part of the machine, and, as might easily be imagined, was only brought to its present marvellous state of efficiency after many patient trials, many alterations, and heavy expense. Great difficulty was experienced in getting the cup manufactured on account of the complications of movement required in imitating the calf's lip and tongue, special machinery having to be manufactured for this purpose alone. The action of the cup on the teat was exactly like the pulsation of the heart, each stroke being felt by putting the finger and thumb either on the outside or inside the cup. Further, this beautiful and most ingenious movement could be distinctly seen, and better understood, by turning up the cup and placing a piece of glass over it, which, excluding the air, permitted the movement to go on as when actually attached to the teat and in full working order. This was a most interesting experiment, and one that gave the best possible idea of its working, the view of its action being so clear and distinct, and the mode of withdrawing the milk from the udder so easily understood. A stroke of fifteen pound, as shown on the gauge, gave sufficient pressure on the teat to withdraw the milk, five pound again opening the lips of the valve, so as to give a fresh pressure, exactly like the action of a calf sucking, or more familiarly, the grasp of the human hand in the act of milking. The teat cups were about the size of an ordinary wine glass in circumference, and just large enough for the admission of the teat without difficulty, and about three times the depth. The four cups joined at the bottom, with a tube attached long enough to carry the milk to the glass cylinder, or trap, on the top of the pail; another tube connecting this glass trap with the exhaust pipe running overhead, and to which it was screwed in. The cups

being placed on the teats, the exclusion of the air was complete, the machine in full working order, and the milk at once began to flow, not, however, in a continuous stream, as most people would imagine, but intermittent, streaming into the glass receiver with each respiration of the pulsometer, just as it did when the hand closed on the teat in the act of milking. The momentary interval between each stroke was exactly the same. It was worthy of notice that the milk frothed up in the pail quite as much as in milking by the hand, the force exerted in either case being about equal. As already noticed, the milk flowed direct from the teat into a glass receiver, and thence to the pail, which was a most excellent idea, as it not only showed in the clearest and most satisfactory manner the action of each pulsation, but it also showed when the milk had ceased to flow, thus enabling the attendant to remove the cups the instant the last drop had been drawn from the cow. No injury, was, however, done to the animal by the suction going on for a few minutes after the flow had ceased, this having been proved by special experiment. In placing the cups on the teats, there was no mechanical arrangement for fixing them on, nor was such necessary, as the attachment by suction alone was so complete at the instant of contact, that they could scarcely be removed by force without injury to the animal, and yet they fall off when the milk was finished with the most perfect ease, by admitting air into the tube and thus destroying the vacuum. The friction necessary to strip the teat was so gentle that the cows seemed rather to enjoy it than otherwise; and, instead of twisting about to avoid being interfered with, most of them stood placidly chewing their cud all the time the cups were attached. It was worthy of notice that two newly-calved cows, that had never before been milked by mechanical agency, stood quietly and let down their milk as freely, and were stripped as cleanly, us the cows that had been milked by the machine for the past twelve months. On the removal of the pails, a man went over the whole of the cows that he saw milked and stripped them carefully, but it was a needless operation, as he only managed to squeeze out about four wine-glassfuls from the entire lot. He examined the udders and teats and found them perfectly limp and soft, and was told that although an average of 20 cows had been milking all through the past year, there was not a sore teat amongst them, the regularity of the pulsation, and the absence of mechanical attachment, contributing in no small degree to such an eminently satisfactory result. The rubber tubes were kept delightfully fresh and clean by letting water from a pipe run through them for a few moments, and then throwing them into a cistern of cold water with a handful of salt. They remain there till again required. By this system the tubes were not only kept clean, but the material was rendered almost imperishable by being kept moist, and free from the action of the air. Rubber was the material used in the manufacture of the cups and connecting tubes, and answered the purpose admirably—being at once soft, pliable, easily cleaned, and durable. The outside rim of the cup was thickened even to rigidity, to give strength to protect the delicate and ingenious breathing apparatus which it contained. The internal, or pulsating, arrangements consisted of several layers of rubber of varying thickness, in imitation of the tongue and lips of a calf in the act of sucking, in the centre of which the teat must be carefully placed—this being one of the most important points in the entire manipulation of the machine, as, if negligently done on any single teat, the milk will not be drawn with the same precision. Some idea might be formed of the extreme delicacy and adaptability of the pulsations, when it was explained that the grasp on the teat was uniform, the pressure commencing at the root of the teat, and finishing at the point, closely following the stripping action of the human hand, and the number of pulsations being from forty-three to forty-six in each minute. The machine he saw at work was designed to milk twenty cows at a time, and would easily, with a man and two lads, milk 120 in an hour by shifting the teat-cups, but could not milk that number all at once, the entire question of numbers resting on a correct calculation of the available power. On Saturday, 23rd March, he was at Lanark and saw the milking of eight cows. Five of the cows were small Ayrshire cattle, which had been milked by the machine before, the other three were rather large beasts, and had not seen a milking machine before to the knowledge of the proprietor. The five small cows showed no symptoms of fear, and quietly gave their milk; the other three seemed shy, but two also submitted to the process. The third cow had recently calved and seemed to be keeping back its milk,

while it continued lowing for its calf, but in a minute or two gave its milk freely. The eight cows were milked within nine minutes, and, allowing for the loss of time caused by one of the cows withholding its milk, he would say the process was accomplished in seven minutes. The power obtained by the exhaustion of air was so equal and so continuous that the furthest off cow from the exhaust tank was milked with the some ease as the one nearest it. The time taken to milk a cow was within five minutes. The time, therefore, to finish a herd of twenty or a hundred must be regulated by the number of teat-cups, pails, and connecting tubes the owner might see fit to provide. The greater the number of appliances, the greater the economy of time, as a large number of cows could be milked at once, and there was less time taken up shifting and reattaching. Although the milker has been in use for over twelve months, it wasnot as yet generally known, as its inventors desired to test and perfect it to the utmost possible limit before offering it to the general public by getting it on the market. Two only had been in actual operation—one at Lanark, the other at Mauchline—the both had given such satisfaction as to warrant the erection of extensive works in the East End of Glasgow for the manufacture of the machinery, which were now completed, and large orders had been already received. (Applause.)

Mr. Thos. Fulton, Shiels Farm, Renfrew, said he had listened with very great pleasure to Mr. Kennedy's description of the machine. He did not expect to be called upon to speak so early in the evening, although he might have offered a few remarks at a later stage. In October last he saw the machine milking ten heifers. They had very small teats ; in fact no farmer would care to buy cows for milking purposes that had such small teats. After the ten were milked, the attendant went over them, but he hardly got any milk left. A fortnight or so afterwards, he went to Auchenbrain, where they had been using the machine for six months upon one of the finest stocks in Ayrshire. All the cows had large teats. They would, therefore, see that it made no difference, so far as the machine was concerned, whether the teats were large or small. Fractious cows seemed rather to like the machine, because it was so natural in its operation, and just like the calf sucking. As regards the glass globe at the top of the receiving vessel, he did not think it was quite necessary. It was, no doubt, a good thing to have a few of these globes to satisfy the farmer that the milk was coming freely away, and that the cow was being milked dry ; but he had never heard of the case where injury was done by the cups by being left on the teats. Before he saw the "Thistle" machine he had the opportunity of seeing another machine at work. It was a most awkward machine, which had to be held between the knees, and it was also very difficult to get the cups attached to the teats. That machine was thrown aside, and he never heard of it again. Referring to the "Murchland" or "Kilmarnock" machine, he said it was wrought with water from a tank placed above the cows in the byre. Mr. Fulton then referred to the working of the "Murchland," the "Grav & Nicholson," and other milking machines, and then said he would like to correct Mr. Kennedy about the expense in connection with the "Thistle." The milking of cows only occupied two or three hours in the day, and at other times the servants were engaged in other work. They could not therefore put their whole expense of service against milking. Where there was no power already on the farm with which to drive the "Thistle" machine, he was of opinion that an oil-engine would be most convenient, and as far as he could gather, one of these which would milk twenty cows, cost about £75. Mr. Fulton was convinced that from its excellence, the "Thistle" machine would come into general use in a few years. (Applause.)

Mr. Kennedy, in reply, said there was not much outdoor work on ordinary dairy farms, and they usually required four milkers to get through the work. There were many seasons of the year when there was nothing, absolutely nothing else to do for these women.

Mr. Fulton said he had spent all his days about a farm, and he had never seen the case in which they could not find something for the women to do.

Mr. James Ritchie asked Mr. Fulton how long it took to milk these ten heifers at Lanark, and also what assistance they required in carrying away the milk from the byre.

Mr. Fulton said he forgot exactly how long it took to milk the heifers, but he thought the machine could milk a dairy of thirty cows in half an hour. The milk was not carried out of the byre at all. It was taken from the cows and emptied in the churns which were standing in the byre.

Mr. Ritchie: A most objectionable custom.

Mr. John Campbell, B.Sc., assistant to the professor of agriculture, and lecturer on dairying in the Glasgow and West of Scotland Technical College, said he was sorry he had not been able as yet to get to Lanark to see the machine at work; but he had been speaking to a gentleman from Ayrshire who was an extensive dairy farmer, who commented very favorably upon the "Thistle" machine, and said it was almost perfect. There was one point about the machine, and it was this, that as soon as it was perfected dairy farming in this country would go down. All the Colonies wanted was a machine of this kind. They had plenty of grass all the year round, and a large extent of virgin soil, and they just wanted a machine of this kind to save labor. Then they would send to this country vast quantities of dairy products. Another point he would mention was in reference to the keeping qualities of the milk. Indeed, although they had a machine of this kind, the milk was not coming in contact with the air, and could not therefore wash from it any deleterious matter. That was the point that would undoubtedly impress itself upon those who had to do with dairying business. The only difficult question was cleaning of the tubes, and he thought that would be overcome. It would be quite easy to get the material that would clean the tubes without in any way harming them or the milk which passed through them. (Applause.)

Mr. Telford, Crown Dairy, Glasgow, said the machine was very interesting to him. because he had never seen it before. The machine would, however, he thought, be a valuable adjunct to the dairy trade, in so far as that a great difficulty with the farmers was to get sufficient milking-maids, and them only at great expense. He noticed that there were two tubes connected with the glass vessel. In the case of a machine milking four cows, would there be four tubes leading to the glass? If so, he was not quite of opinion, like Mr. Fulton, that the glass could be done away with. It was necessary to see that every teat was giving its milk. They knew that in some instances there were some cows very much worse to draw than others. Would the same amount of suction draw the milk from those cows that were harder to milk than others? On the other hand, he was glad that the difficulty had been overcome with regard to over-milking or over-drawing, because he knew that in the case of other machines that had not been so. All of them were aware of the result. Mr. Telfer knew of nothing that was so injurious as to have streaks of blood in their milk. These went to the bottom of the vessel, and they were seen when the milk was emptied out.

Mr. Kennedy reminded Mr. Telfer that the milk from the four teats met in one tube, and was carried to the receiver. The other tube was for extracting air from the milk pail or receiving can. To cease the milking of one cow did not affect the others. There was a small crane the turning of which destroyed the vacuum, and the teat cups fell off. The India-rubber closed over the metal and stopped the air.

Mr. Semple, Hillhead, said the first point that struck him was the stripping of the udder so cleanly. The great difficulty he had with his servant maids was to get them to milk the cows clean. If they could manage to bring down the price of the machine, it would go like steam.

Mr. John Kean said he would have liked very much to have seen a greater number of farmers present. They were often much troubled by milk being late about the term time. If this machine was coming into use, it would be better for all parties, as they would know that their milk was brought to them in a proper sanitary condition.

Mr Fulton reminded the meeting that they had assembled just a month too late to have a large attendance of farmers. They were busy at home sowing.

Mr. Bachelor, Craigie, Dundee, said that where he came from they paid women so much per milking. They had fifty cows, which were milked by five women. Three of

them were the men's wives on the place, and the other two were connected with the house. The men's wives were paid 3d. per milking, or 9d. per day. Each woman was supposed to milk ten cows for 3d.

Mr. KENNEDY: Labor is evidently cheaper there than with us.

Mr. BACHELOR: Don't you think you will get them to do it for that here?

Mr. KENNEDY: Not for double that.

A member said the general rate was 1s. per milking.

Mr. BACHELOR said he could not pass any opinion on the machine, but he would like to know what would be the result if anything went wrong with the motive power?

Mr. JOHN BEATTIE thought the machine was too dear. If it could be brought down to £20 it would be a great inducement for them to go in for it. It would take the price of three or four cows to pay for a machine at the present rate.

The chairman said the machine seemed, from practical experience, to be the right thing, and a very successful patent. That had been proved by the two instances given, and by the observation of their practical friend, Mr. Fulton. Of course patents were were always dear to begin with, but they must just reckon it this way, that the farmer could get the work done at half the cost, which was about the correct value. Like Mr. Fulton, he did not think women about a farm had much idle time. They would have more idle time in the future. It was unreasonable the time they had to work at present, and it would not bear investigation. Of course the present demands on labor were great, but it was a question if the public had a right to insist upon an unreasonable thing from a brother or a sister. The machine would be the means of saving labor. That was beyond a doubt. As to sanitary reform in reference to dirty hands, dirty clothes, and so forth, the machine was certainly a secure safeguard. The only thing he saw about the machine that he did not care for was the India-rubber tube. Mr. Campbell said something could be got to clean it. He had no doubt that was right. The patentees would likely look to that. It had been the experience of those who wrought with India-rubber about milk—he did not say it was the same quality as that before them—that it very soon got into holes on the inside. Now, if cracks were getting into the inside of these tubes, he could not see what antiseptic they could use to bring it out. But he had no doubt they would yet substitute the piping for a large portion of the tubing. As regards the stripping he was relieved to know that they could take off the cup by admitting the air. If there was one risk they had to run it was the stripping of the cows. The milk was often taken and the cream left. In any case, the last four gills that were left in the can never came to Glasgow. (Laughter.) He hoped they would patent this machine in such a way that the cup would not come off until the cow was dry. The machine was certainly of great interest to them as dairymen, because they were concerned with everything that was connected with the handling of milk. (Applause.)

Mr. KENNEDY said the question of milking was one of those things which would be considered in working out the details. He maintained that at the present price the machine was cheap by the labor it saved.

On motion of Mr. John Logan, Mr. Kennedy received a hearty vote of thanks for his lecture, and for showing them the working of the machine.

Those present were afterwards permitted to examine the construction of the machine, and to see how it was manipulated.

During my recent visit to Scotland, I found that these machines were creating considerable stir. I visited two farms in the vicinity of Kilmarnock where they were at work. At the first the Murchland machine had been in use several years, and the farmer, Mr. McFadyean, told me it worked well. The chief point of merit which he mentioned was the fact that it enabled him to do his milking with less help than formerly and with less experienced help. The power was supplied by hand, a good strong Scotch

girl furnished the energy to drive the pump handle. Mr. Murchland showed me an oi engine that would do the work very cheaply. The inventor, a sturdy Scotchman, appear to have great faith in the possibilities of his machine.

Early in the year one of the Murchland milkers was sent to us for trial. We set it up and made a number of trials, which were not altogether satisfactory, chiefly on these grounds:

1. We had difficulty in securing sufficient pressure to hold the cups on the teats and to milk the cows. This can be remedied, to some extent, if not altogether, by having a larger water tank overhead. The one we used is too small to hold the pressure.

2. Our cows did not give so much milk as when milked by hand, nor did the machine milk all the cows out clean.

3. The per cent. of fat was always less when the machine was used.

The two latter difficulties might disappear when the cows became accustomed to its working, though they did not appear to mind it very much. We hope to make some further trials with this machine.

Another milking apparatus was sent here by a Mr. Armstrong, from the Province of Quebec. A pail was suspended under the udder by means of a strap passing over the cow's quarters. Quills, something the same as milking tubes, were inserted in the teats and the milk allowed to flow out. Most of our cows objected to the pail, and the effect of the tubes or quills was to cause the cow to give thick or bloody milk in a short time. I think this apparatus is not constructed on sound principles, though we made several trials to convince ourselves, before finally abandoning the apparatus, as the sender seemed so confident of its utility.

As to the third, the Thistle milking machine, I can only say that it appears to give good satisfaction to Mr. Wallace, at Auchenbrain, Scotland, whose farm I visited and where I saw several cows milked with the machine. At the time of my visit Mr. Wallace was milking forty cows, but only half of these were milked by machinery. He informed me that if any cow showed a dislike for the machine he would not persist in milking her with it. Other reasons induced him to use it on but half the herd. On the morning of my visit I saw seven cows milked in eighteen minutes with four pails, Mr. Wallace attending to these himself. I noticed that he was careful to start each teat, and to wet them before applying the cups. He also went over the cows after the machine to be sure that all were milked out clean. The average time to milk each cow was seven to ten minutes. One cow, a very hard milker, which used to take two women fifteen minutes to milk her, was milked with the machine in ten minutes. This cow gave three gallons of milk. She had very short teats.

One of these machines was sent to the dairy in July, and as I was away at the time, I cannot do better than quote your letter which you sent to the press on the results of trials here:

A Milking Machine Tested.

Sir,—When the Hon. Thomas Ballantyne, of Stratford, was in Scotland last spring, he had an opportunity to examine carefully what is known as the Thistle milking machine. He was pleased with the work which he saw the machine doing, and, being anxious that Canada should be abreast of the times in everything pertaining to the dairy industry, he suggested to the makers that they should send a machine to the Agricultural College, Guelph, to be tested and reported upon.

The machine came, was set up, run for seven or eight days, and, in the absence of our Professor of Dairying, I beg to submit for the information of your readers, a brief report of the results of the test, which closed on Friday, the 9th inst.

The Thistle milking machine was invented about four years ago by Alexander Shiels, M.B.C.M., B.Sc., of Glasgow, Scotland, and is now manufactured in the same city, 25 Gateside street, by the Thistle Mechanical Milking Machine Company.

The machine has been tested by a number of competent judges in different places, and is now being used by some of the most prominent Scotch dairymen, including Thomas Kerr, Kirkcudbright, who has a herd of eighty cows; Robert Wallace, Mauchline, forty cows; and Mr. McBride, Garroch Tree, Staneear, one hundred cows. One was put up a short time ago for D. H. Burrell & Co., Little Falls, N.Y., and I believe the only one in Canada is that which has lately been at work in our dairy stables.

The company makes a hand machine to milk four cows at once, and a three horse-power machine to milk ten. I have not seen the hand machine, but we have tested the power machine, and I have no hesitation in saying that it does its work very satisfactorily.

The machine is a large air pump of special and peculiar construction—of good quality, strong, substantial and well made. It is set on a concrete foundation, made of gravel, cobblestones and Portland cement, three feet three inches by four feet, and two feet deep, outside of our dairy stable, and close to the wall of the building and a short distance from a row of fifteen cows, opposite which there is another row of the same number of cows, with a feed passage between. A copper suction pipe, passes from the pipe through the wall into the stable and overhead to the passage between the two rows of cows. From this main tube, two smaller copper tubes are carried along on top of the stall divisions, one above the necks of each row of cows and in each stall, at the side of each cow, there is an opening in this cross tube, from which a short piece of smaller copper tube points downwards, slanting towards the passage behind the cows. This smaller piece of tube in each stall is controlled by a stop-cock; and to it a rubber tube is attached when milking begins. This moveable rubber tube extends down to a heavy, broad-bottomed tin pail on the floor, and another rubber tube connects the pail with the teat-cups which are attached to the udder.

For milking ten cows, ten pails and ten sets of teat-cups are used—five for each row of cows, so as to keep the two suction tubes in front of the two rows of cows working at the same time. It, of course, takes less time to milk some cows than others; so, when a cow is milked, the man in charge shuts the stop cock, detaches the rubber tube, empties the pail into a large milk can standing close by, removes the apparatus (the rubber tube, pail and teat cups) to another stall, and places them in position to milk another cow.

In this way he keeps on moving the pails from stall to stall, one at a time, till all the cows in his row are milked. Another man or boy does the same thing in the opposite row. It is not necessary, however, to milk both rows of cows at once. The ten pails might all be used on one side, in which case a man, or a man and a boy, could attend to them and keep his eye on the working of the pump.

As stated below, the milk pail is heavy, broad and low, so that it is difficult to upset. The cover is soldered on and the milk enters through a strong glass bottle which is inserted like a cork into the lid at one side, resembling a bottomless quart fruit jar, but only about half the length. By observing the glass bottle, one can see how the milk is flowing from the udder and know when to stop milking.

Owing to the action of a reducing valve which is used for the admission of air at regular intervals, the suction acts in a series of successive pulsations, resembling the action of the mouth of a calf in sucking, or the hand in milking, and varing in the proportion of fifteen to five. As the suction increases, the teat cup contracts first at the top and then gradually downwards to the bottom, forcing the milk out of the teat; when it reaches the maximum of fifteen, air is admitted which reduces it to five thereby partially releasing the teat and allowing it to fill with milk again. In this way the milking is done naturally, quickly, thoroughly and without any annoyance to the cow. The machine operates more regularly than the hand. Hence it is likely to produce better results, and it makes it next to impossible for any kind of dust or dirt to get into the milk during the progress of milking.

We used our portable farm engine in making the test; and we found that a man and a boy could milk twenty-six cows in from twenty to twenty-six minutes. I think it might be arranged so that one man could milk nearly as many in the same time.

We weighed and tested the milk from each cow as usual, and found about the same quantity as was obtained by hand, but a marked fall in the percentage of fat, due, we

have no doubt, to the excitement caused by the noise of the machine and the presence of a large number of people in the stable. As the cows became accustomed to the noise, the percentage of fat gradually increased.

I have had no communication with any member of the firm, and have no interest to serve in recommending the machine; but I must say that, in my judgment, the inventor deserves great credit for what he has done to remove one of the chief obstacles to successful dairying on a large scale. The only thing to prevent this machine from being extensively used is the cost of the machine and of the power necessary to run it.

JAMES MILLS,
GUELPH, August 15th, 1895. President Agricultural College.

BREWER'S GRAINS FOR DAIRY COWS.

During the past season, one of the patrons from whom we purchase milk for cheese experiments commenced feeding brewer's grains to his cows. Soon after, a peculiar flavor developed in the milk, in the curd, and more particularly in the cheese. Our cheese-maker, Mr. Stratton, went to see the person about it, but he did not cease feeding the grains until after my return from Europe, September 12th. As a consequence, part of our August cheese, and most of the September had a flavor like yeast. This flavor continued for nearly two weeks after the feeding of the grains was discontinued, and I would warn all factory men and all patrons against allowing any of these grains to be fed to cows giving milk for cheese or butter-making. It is one of the worst flavors I ever experienced in cheese, and experts who have sampled them pronounce the flavor a peculiarly bad one.

FLY-TRAP AND PREPARATIONS TO KEEP OFF FLIES.

We have tried the various preparations that have been recommended to ward off flies from cattle, but have found them somewhat troublesome to apply, as well as expensive and some of them useless. In addition, the strong smelling compounds, such as fish oil and carbolic acid, coal oil, etc., are apt to give a flavor to the milk when applied in the stable. Where these are used, I would recommend that they be applied *after* milking, so that the odor would pass away more or less before the next milking time.

During the past season, we have been using the Guthrie fly-trap, and it has given good satisfaction. At first, we had considerable difficulty in getting the cows to go through; but later, after they became accustomed to it, they were anxious to go through and were eager for their turn. The trap of 1894 we could not recommend. We suggested some improvements, which have been made on the trap of 1895, and it works well. But it must be admitted that a great many flies were left to annoy the cows, notwithstanding the large number caught in the trap.

FARM BUTTER MAKING.

Co-operative Dairying Best. The co-operative or factory system is the best system for the mass of farmers, yet there are many who, from choice or necessity, will manufacture dairy goods on the farm. The product made will be chiefly butter, though some find that fancy cheese, and soft cheese find a ready home market at remunerative prices. Wherever practicable, we advise adopting co-operative dairying, as "creamery" butter and prime factory cheese will supplant the "dairy" butter and cheese in the near future, except under special circumstances.

The Dairy Herd. Select cows that attain a standard of 6,000 pounds of milk, 600 pounds of cheese, or 250 pounds of butter in a year, and keep none below this standard. This can be done only by weighing and testing the milk of each cow in the herd and not by guessing at the capacity of each cow. A *few* good cows are more profitable than many poor ones, and more profitable than a few good ones and more poor cows. Buy good cows if they can be purchased for $35 to $45, but as a rule they must be bred. If it is not

desired to engage in the breeding of pure bred cattle, select the best grade or native cows in the herd and mate them with a pure bred male of a large milking or butter strain. He will usually be found to belong to one of the *dairy breeds*. Heifers bred in this way, if properly cared for, are likely to make excellent cows. Good heifer calves for the dairy may be raised on *sweet*, *warm*, skim-milk, together with some boiled linseed, oilcake, meal, clover hay and a few roots, after getting a start on the first milk from the dam and afterwards whole milk for about two weeks. These heifers should drop their first calves at from two to two and a-half years old. Aim at having some fresh cows each month in the year, as they will tend to keep the flavor of milk and butter up to the standard. This plan will also furnish material for a continuous dairy, which is much more satisfactory and remunerative than a dairy which closes down part of the year.

Feeding. A succession of soiling crops in addition to pasture should be ready for summer use, and it may pay to feed some bran or other meal. A mixture of pease, or vetches and oats, in the proportion of two bushels of oats to one bushel of pease or vetches, sown at three different periods of about ten days apart, and at the rate of two to two and a-half bushels per acre, is a safeguard against drouth and a shortage of milk. Corn will come in after this crop. For winter feeding, corn silage is the cheapest bulky food. Some clover hay, with mangels, sugar beets, or carrots, and six to ten pounds of meal a day, in addition to the corn silage, will maintain the milk flow. Swede turnips or turnip tops should not be fed to milking cows unless the persons who eat the butter like this "turnipy" flavor. For the general market keep turnips out of the ration.

Care of the Cows. Cows should have plenty of pure water and access to salt at all times. Stables and cows need to be kept clean. Proper ventilation of the stable is important. Brushing and carding will pay. Land plaster and whitewash should be freely used —the one in the gutter and the other on walls and stalls. KINDNESS should be the rule in the treatment of dairy cows. Endeavor to make the cow comfortable and she will endeavor to make her owner comfortable. A motto of the dairyman is breed, feed, weed, and hustle.

Dairy Utensils. As many as possible of these should be made of tin, containing no seams or crevices. A dairy thermometer (glass) is a requisite. Procure the best utensils, as they will save labor. A brush should be used in washing nearly all dairy utensils. Any vessel which has milk in it, should first be washed in luke-warm water, then in hot water, then scalded, and placed in the sun and fresh air. Woodenware should also be thoroughly washed with a brush, scalded, and then aired, but not left in the sun long enough to crack or warp. Below is a list of most of the utensils needed for farm butter-making, together with the probable cost:

A barrel or box churn, size to suit herd	$3 50	to	$7 00
A lever or roller worker	2 00	"	5 00
A butter mould—size, one to two pounds	45	"	3 00
A shipping box, with ice box in centre and wooden trays	3 00	"	4 50
A thermometer (glass)	20	"	50
A salt sieve (hair)	30	"	75
A pair of scales, to weigh quarter ounces	3 50	"	5 00
A buttermilk strainer—size two to four quarts—with perforated tin bottom, fine mesh	25	"	50
A butter ladle	20	"	40
A cream pail (tin, with handles on sides and tin stirring spoon)	1 00	"	1 50
Creamer cans and box for cold water (eight cows)	5 00	"	20 00
A cream separator (ten or more cows)	100 00	"	150 00
A brush for cleaning utensils	20	"	30
A supply of washing soda or borax			
A supply of good butter salt, per sack	70	"	1 60
Butter color, if thought advisable to use it, per bottle or per gallon	25	"	3 50
Parchment butter paper ..... per 1,000 sheets	1 40		
Babcock milk tester (four bottles)	7 00		

The Dairy—Man or Women. He or she must be clean, neat and tidy. Everything in and about the dairy should be a model of cleanliness. Business ability and good judgment are also requisites of the successful dairy manager.

Milking. The cow's udder needs to be brushed before commencing to milk. Milking should be done quickly and with regularity. It pays to "strip" the cows, and thus secure all the milk, as the last portion is rich in butter fat. Straining is best done at once after milking, by using a fine wire strainer and two or three thicknesses of thin cotton.

Creaming. There are three methods of creaming now in general use: shallow pan, deep setting, and separator. Which system will be best, depends upon circumstances. If a small number of cows are kept and no ice, nor spring water below forty-five degrees is at hand, then small shallow pans will be best. For a larger number of cows—up to ten—and where ice can be obtained, deep setting in cans about eight inches in diameter and about twenty inches deep will be satisfactory. With ten or more good cows, use a cream separator, and we would recommend buying one which has a capacity of at least 500 pounds (50 gals.) of milk per hour. When tired of turning by hand (which will be in a short time), power may be attached with good results. We have found the tread power satisfactory for running the separator at our barn.

Shallow pan setting needs much space, pure air, a moderate to cool temperature, and skimming at from twenty-four to forty-eight hours—before the milk becomes thick.

For deep setting, it is important to cool the milk to a temperature of forty-five degrees or below. Skim at the end of twelve hours in summer and twenty-four to thirty-six in winter. The cans may be submerged, or surrounded by water as high as the milk in the cans. They may be skimmed from top or by drawing off the skim-milk at the bottom. Where the separator is used, have the temperature of the milk from eighty-five degrees to ninety-five degrees, the speed of the machine full and constant, and the feed regular. Test the skim-milk and note if there is any loss of fat. Secure the cream quite thick, and cool immediately to about fifty degrees. Keep all cream about this temperature until sufficient is obtained for a churning, then warm to ripening temperature by means of a water bath. Stir the cream while it is being warmed by the use of a tin stirrer.

Ripening Cream. The ripening temperature will vary with the seasons, cows, and kind of cream. The temperature should be such that the cream will ripen in twenty-four hours with or without a "starter." A "starter" may be made by heating some skim-milk from a fresh cow to ninety degrees the day before the cream is to be set to ripen. Throw away the top portion of the thick skim-milk and add to the cream from two to ten per cent. of the finely broken "starter." Stir it well into the cream, and leave it undisturbed until twenty to twenty-four hours after, when it should be ready to churn. The buttermilk may be used for "starter," so long as it is of good flavor. Give the cream a good stirring before putting it into the churn.

Churning. A simple box or barrel churn we find the best. To prepare it for churning, first scald and then cool. Strain the cream into the churn and it will prevent white specks in the butter. If coloring is used, it should be put into the cream before commencing to churn. The churning temperature will vary a great deal. Thick separator cream may be churned at fifty degrees. Thinner cream may be churned at fifty-six degrees to sixty degrees in summer, and up to seventy degrees, as the season advances. Have the temperature such that the butter will come "firm" in from twenty to forty minutes. Close covered churns must be ventilated two or three times during the first ten minutes of churning. When the butter "breaks," add a quart or more of water to the churning for each pail of cream. The temperature of the water added at this stage should vary according to season—cold in hot weather and warmer in cool weather. The object is to assist separation of butter from the butter-milk, and to temper the granules of butter. If the water is too cold in winter, it will prevent the grains forming the

proper size. The churn should be stopped when the grains of butter are about the size of small wheat kernels. The butter-milk may then be drawn off through a strainer, or the granular butter may be dipped out of the butter-milk by means of a sieve, which is the Danish practice.

Why Butter Does Not Come. The chief reasons are:

1. The temperature is not right—usually the cream is too cold in the churn.
2. The cream may have been kept too long.
3. The cream of a "farrow" or "stripper" cow may be the cause of the trouble.
4. The cream may be too thin—get rid of some of the skim-milk.
5. The cream may be too thick—add a little skim-milk or water.
6. The churn is too full.
7. The maker is incompetent.

The process of churning is the packing together of tiny fat globules, and anything which hinders this tends to prevent churning.

Washing Butter. Where a highly-flavored, short-keeping butter is wanted, do not wash at all. For prints to be eaten in a week or two, wash once, and for tub butter, to insure keeping quality, washing twice, or until the water comes away "clear," is a safer practice. Do not leave the butter standing too long in the water, as it will spoil the flavor.

Salting and Working. Fine butter salt (the use of coarse, lumpy salt is not advisable) at the rate of half an ounce to one ounce to the pound of butter may be sprinkled on the granular butter in the churn or on a worker. Some salt with strong brine. If salted in the churn, a portion or all of the working may be done by revolving the churn slowly after allowing the salt time to dissolve. Expert butter-makers may work butter once. Others will succeed better by working twice. Work by pressure and avoid a sliding or grinding motion. When the "streaks" have disappeared, the butter is firm and waxy in texture, and the excessive moisture is removed, it is then worked sufficiently.

Printing and Packing. For immediate use, the "print" of various sizes is a desirable package. It should be wrapped in good parchment butter paper. The tub, firkin, or cube package, is best to pack butter in for export, or if it is to be kept. The butter should be solidly packed in the tub, then be covered with butter cloth or parchment circle and a quarter to a half an inch of salt paste to exclude the air. Brine should be added from time to time. Keep in an even temperature. Prepare these wooden packages by soaking for a day or two in brine, then scald, and cool, and line with parchment paper.

Marketing. Do not trade good butter for dry goods and groceries at (for you) starvation rates of exchange. If possible, secure customers in a village, town, or city and send them your best-make regularly. Selling to a reliable commission house or grocery-man (for cash) is a good way to market. A suitable shipping box with ice-chamber is necessary to send butter any distance in hot weather. Have a brand for your butter and sell none but the best with your brand on it. If a churning goes wrong, sell it for what it is worth without branding.

Excursions.

As usual, we had a large number of excursions in June and July, and many visitors during the whole season. We have endeavored to make the visits of these persons pleasant and instructive by running the cream separator, testing milk, churning, making cheese, and giving addresses on dairy topics. We trust soon to have the various implements of the dairy properly named, with capacity and chief points suitably printed, that visitors may be better instructed as to the uses of the various machines used in dairy work.

Correspondence.

The correspondence has been quite heavy during the year. A great many writers make inquiries that often require considerable time to answer. Several have replied acknowledging assistance received from advice given in letters from the Dairy Department. A supply of bulletins and pamphlets covering the common troubles of the dairy make this work very much lighter than it otherwise would be.

Needs of the Dairy Department.

1. A man in the dairy stable and piggery to do experimental work in feeding and to assist in milking and other work so far as his time will permit.

2. A continuation of the Dairy School on a smaller scale throughout the year for the benefit of cheese and butter-makers. Quite a number have come to the dairy during the past year and stopped for a short time to pick up any new things in dairy work. This should be encouraged to a greater extent. The month of June might be devoted to special classes in farm butter-making and experimental work for the benefit of students in both butter and cheese-making.

3. A system of cold storage or a refrigerator suitable for storing experimental cheese and butter. This is needed very badly as we have no suitable place at present for storing cheese and butter made during the experimental season.

4. A system of ventilation for the cheese-curing room and for the dairy stable.

5. A curing room that can be kept moist and cool for the curing of fancy cheese The cheddar curing-room is wholly unsuited for the latter class of cheese.

All of which is respectfully submitted.

H. H. DEAN,
Professor of Dairying.

Ontario Agricultural College,
Guelph, December 31st, 1895.

PART VII.

REPORT OF THE AGRICULTURIST.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit herewith my third annual report. Though I must confess that the work accomplished during the past year has, in some respects, fallen considerably short of what I had expected, still, certain important preparatory steps have been taken in the direction of developing the work in which I am especially interested.

My work may be most conveniently reported under five heads: farmers' institutes, lectures, correspondence, bulletins and experimental work.

Farmers' Institutes. From January 2nd until January 22nd, 1895, accompanied by Messrs. L. Patton, Oxford Mills, and M. McNabb, Cowal, I attended institute meetings in the counties of Frontenac, Leeds, Grenville, Dundas and Stormont. As a report of these meetings has already appeared in the *Report of Farmers' Institutes of Ontario*, it is unnecessary to say anything further regarding them.

Lectures. The lectures to students have followed very closely the course outlined in the College Circular. The work during the present College year is somewhat different, however, from that of previous years, owing to the fact that the third year work has been divided into special departments, and that agriculture and dairying comprise one of these departments. During the full term just closed, the third year students have devoted the time allotted to agriculture, to practical work in judging cattle, sheep and hogs. The remainder of the year will be devoted to the study of pedigrees, principles of breeding, the scientific principles which underlie the various operations of soil, tillage, etc., the different branches of agriculture being discussed much more fully than was possible during the first two years of the student's course.

It is my intention, if the plan meets your approval and the approval of the Minister of Agriculture, to arrange for practical work in experimental feeding, for the third year students who take agriculture as their special department. Such an arrangement would occasion some extra expense; but, as a means of education, I believe it would be well worth the money expended. However, for reasons which appear in another part of my report, I fear it will be impossible to give the present class the benefit of such training.

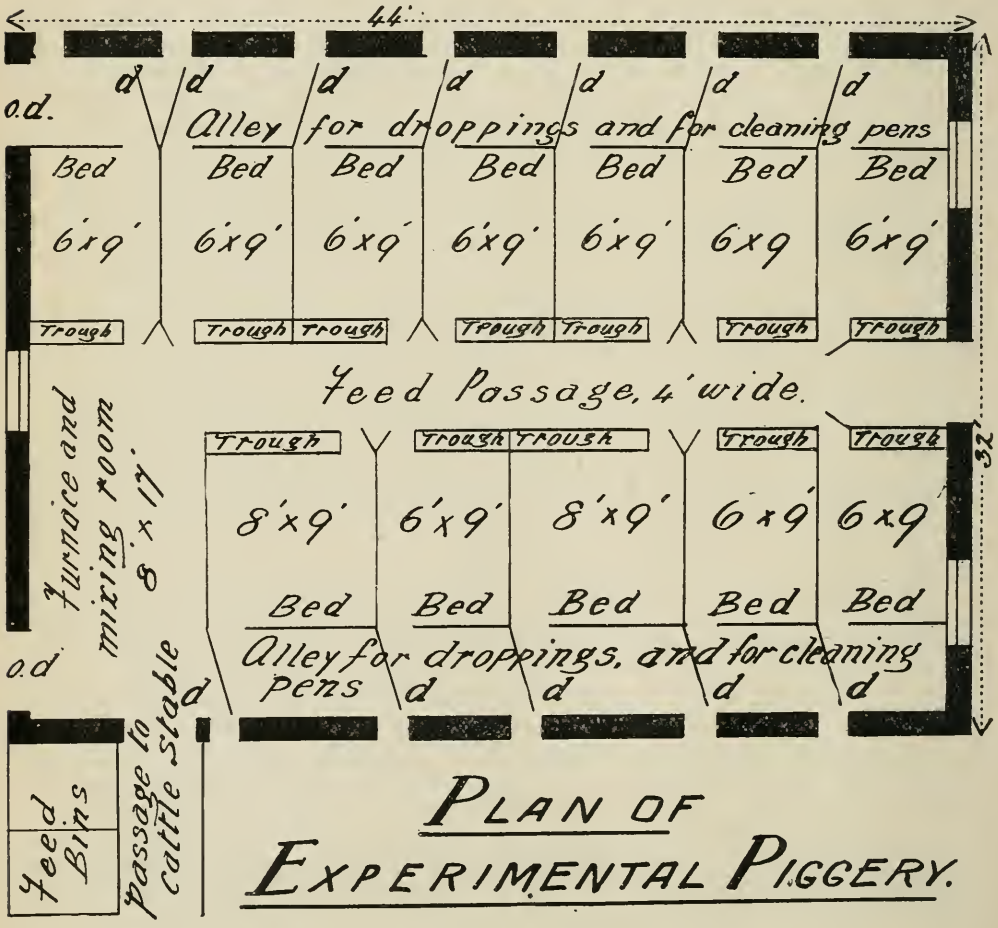
The new live-stock class-room is comfortable, commodious, and well adapted to the purpose for which it is intended. With such improved facilities, I hope to be able to make the study of live stock still more interesting and profitable to the students.

Correspondence. During the year, a great many letters have been received, containing inquiries regarding almost every department of farm work, though the greatest part of them concern stock feeding. To answer these questions satisfactorily requires considerable labor and careful thought, and constitutes a work of such importance and responsibility, that I have thought it not unworthy of this brief mention.

Bulletin. During the past summer, Mr. Harrison and myself prepared a bulletin on some of the more important grasses found in Ontario. The bulletin is designed for the student and the farmer; and, in addition to a full botanical description of each grass, it contains notes on the utility of the different grasses, together with brief notes on the cultivation of grasses in general. Moreover, the bulletin is illustrated with excellent plates of the grasses mentioned.

Experimental Work. In last year's report, I stated that I expected to commence a number of experiments in stock feeding, during the present year. A small grant was asked for the purpose of fitting up suitable buildings, and the work of preparation was commenced early in the spring. A building which was already on the ground, has been partially fitted for the accommodation of cattle and sheep, and a new building has been erected, but not yet completed, for an experimental piggery. The College carpenter has had so much other work on hand, that, as yet, he has been unable to complete the buildings in question. For these reasons, no work in experimental feeding has been commenced, nor is it possible, as previously mentioned, to give the third year students practical work in experimental feeding.

A plan of the experimental piggery is given below:



PLAN OF EXPERIMENTAL PIGGERY.

The building is 44 x 32 feet. The walls are composed of gravel and Queenston cement, and are one foot thick, thus making the building 42 x 30 ft. inside. The main feature of the plan is the four foot alley which runs next to the wall on each side of the building. This alley contains doors (marked *d.*), which are hinged to the partitions between the pens, and fasten to the wall. Thus the hogs have free access to the portion of the alley opposite their respective pens, and may use it for their droppings, thereby keeping clean the part which contains their trough and bed. When it is required to clean the pens, the doors are swung back against the partitions, shutting the hogs into the pen which contains the trough, and leaving a continuous passage from one end of the building to the other. A wheelbarrow can be taken into the passage, or alley, and the manure wheeled outside through the doors marked *o. d.* The drainage is towards the manure alleys. The floor is of cement, but planks are laid on the cement over those portions intended for the beds, thus raising the beds two inches above the rest of the floor. The pens are made small to accommodate small lots for experimental feeding.

In concluding my report, I wish to express my appreciation of the comfortable office provided for me in the Experimental Building. My department is now better equipped than ever before, and I shall endeavor to take advantage of improved conditions, and render the more effective service which they demand.

I have the honor to be, Sir,

Your obedient servant,

G. E. DAY,

Agriculturist.

Ontario Agricultural College,
Guelph, December 31st, 1895.

PART VIII.

REPORT OF THE HORTICULTURIST.

To the President of the Ontario Agricultural College :

Sir,—I have the honor of presenting herewith the report of the Department of Horticulture, for the year 1895.

With fruitgrowers generally, the year has been in many respects, an unfavorable one, yet from the varied nature of the work here, I am glad to be able to report progress.

The year's work in this Department can be reported on most conveniently under the following headings :

I. Teaching.
II. Management of the Horticultural Department.
III. Inspection of Fruit Experiment Stations.
IV. Co-operative Fruit Testing.
V. Bulletin Published.
VI. Meetings Attended.

I. TEACHING.

It has been our endeavor during the year, to make all students, under our charge, as proficient as possible, in both the theory and practice of Horticulture. Instruction has been given by means of lectures in the class-room and practical work in the orchard, garden and greenhouse.

The course of lectures, as outlined in the College Circular, covers as fully as is thought practical, the subjects of Fruit Growing, Vegetable Gardening, Floriculture and Landscape Gardening. These lectures have been given twice a week throughout the greater portion of the year, to the second year students. Beginning with the fall term, lectures have also been given to the students of the first year. Upon the revision of the course of study for students of the third year, in which they now have the opportunity of devoting special attention to one or more of the branches of study taken up here, an advanced course in Horticulture has been arranged with special lectures, reading and laboratory work.

During the past year special attention has been given to practical work. We find that the best way of making a student understand any particular operation is to allow him to perform that operation himself. Accordingly, two afternoons a week, have been devoted to such work as the pruning of apples, pears, raspberries, currants and gooseberries; pruning, training and trellising grapes; practising the different methods of grafting on hard and soft wooded plants; preparing spraying mixtures; originating new varieties by hand pollination; germinating and testing seeds; transplanting seedlings; potting and handling house plants, etc.

Much interest has been taken in this work. In an accompanying illnstration, may be seen a section of the class in Horticulture busy at the work of hand pollination, upon tomatoes and petunias growing in the Horticultural laboratory.

II. MANAGEMENT OF THE HORTICULTURAL DEPARTMENT.

The work of this Department, aside from teaching, is of a varied character. It embraces the care and management of: (1) The orchards and fruit plantations; (2) Vegetable garden; (3) Lawn and grounds; (4) Arboretum and tree clumps; (5) The greenhouses. All of these are made use of, as far as possible, to give instruction to students; and the work in them is conducted so as to be an object lesson for both students and visitors.

Orchards and Fruit Plantations.

On account of the unusually late, severe and prolonged frosts in the spring, the fruit crop here, as in all other inland parts of the country, was almost an entire failure. Not only the young fruit and blossoms were destroyed, but in many cases the leaves and young wood were killed as well. Happily such seasons are not of frequent occurrence; and when they do come, there are always some of the more favorably located sections of the country, which are able to furnish the much needed supply of fruit.

Although the trees this year bore little more than disappointment, they were as carefully attended to as usual, in the hope of better returns in years to come. They were kept well cultivated up till midsummer, when the ground was sown to millet to help make up the shortened supply of fodder for farm stock. This crop, coming on so late in the season, interfered little or none with the growth of the trees, and gave a fair return from the land for the season's work. Careful attention was given to spraying, to hold in check fungous diseases. In the spring, before the buds opened, all fruit trees were sprayed with a solution of copper sulphate, 1 pound to 25 gallons of water. Before the blossoms appeared and again after they had fallen, the trees were sprayed with the Bordeaux mixture, made according to the following formula; copper sulphate, 4 pounds; lime, 4 pounds; water, 50 gallons. These sprayings were given for the purpose of preventing fungous diseases on the foliage, as well as on the fruit, should there be any. At each of the later sprayings, 4 oz. of Paris green were added to the mixture to destroy all leaf-eating insects. On account of the comparative exemption from apple-scab and other fungous diseases this year, the effect of these sprayings with copper sulphate was not so noticeable as in other years; yet they were a safeguard, and, no doubt, were of some use. The Paris green in the mixtures, however, was quite effective in keeping in subjection the tent, red-humped and yellow-necked caterpillars.

Early in June, when the beetles of the flat-headed borers were active, the trunks of all young fruit trees were washed to prevent these insects depositing their eggs. The wash was made by adding to a thick paint-like solution of soft soap, enough crude carbolic acid to give it a strong smell, which is offensive to these beetles. Besides preventing the attacks of the borers, this wash gives a clean, thrifty appearance to the bark of young trees.

Grape vines were most seriously injured by the spring frosts. Owing to the unusually warm weather for two or three weeks preceding the frosts, the vines had made a growth of a foot or more in length. All of this was destroyed, and in most cases the old wood was seriously injured as well. At the time, it was doubtful if it would not be better to cut the vines off at the surface of the ground and allow them to start afresh from the roots. As an experiment, half of the vines were so cut down and the remainder left untouched. Those cut down made a strong growth, which was directed by summer pruning into such canes as were needed to form new vines. In most cases, good vines were formed, but it will really take another year to make full sized vines again. They will, however, be in better shape by that time than those not cut back. The latter made a very irregular growth, and although most of them made a few strong canes, which should bear fruit another year, yet they will never make well shaped vines till started afresh from the bottom.

Currants and gooseberries were well formed at the time of the frosts, and only that fruit borne in the centre of the bushes and well protected by the leaves, remained on and came to maturity.

The fruiting wood on the raspberries was not so seriously injured by the frosts as the new canes coming from the ground. The blossoms had not yet appeared and therefore escaped injury. The crop from these was a good one, the fruiting season being considerably lengthened by timely showers.

From the strawberry plantation set out a year ago last fall, a good crop of fruit was expected this year. The vines were covered during the winter, with a heavy mulch of coarse stable manure, which was left on until growth commenced in the spring. It was then raked off and tramped down as a mulch between the rows. During the warm weather in the early part of May, the plants made a vigorous growth and at the time of the frosts were out in full bloom. The crop, consequently, was materially lessened ; only those plants having strong fruiting crowns, sent up a second lot of blossoms.

A new plantation of strawberries was put out this year in the vegetable garden, the intention being to bring strawberries into our regular rotation of garden crops. This plantation includes 123 varieties, many of which are new in Ontario. The blossoms this season were picked off to throw all the vigor of growth into the plants. Previous to planting, the ground was deeply sub-soiled and well worked. The planting was done in the spring, as early as the ground could be got ready, and, notwithstanding the severe drouth which followed, very few of the plants failed. With frequent and clean cultivation during the summer, the growth was remarkable. After the ground had frozen hard this fall, the plants were covered with a heavy covering of coarse stable manure. The coarsest of this will be raked off in the spring and left between the rows for a mulch. It is expected that some valuable information may be obtained next year as to the productiveness of all these different varieties grown under the same conditions.

It is the intention of this Department to devote more attention to fruit growing. This is a branch of the work here which needs developing. With a view to extending our orchards and fruit plantations, field number thirteen has this summer been thoroughly underdrained. This field contains twenty acres, about four acres of which was four years ago planted to fruit. The remainder will be taken up, as required, for growing and testing whatever fruits can be grown in this section.

The Vegetable Garden.

A year ago this fall, the vegetable garden was thoroughly underdrained, and the benefit of this was very noticeable in the spring. The lower parts of the garden for years past have been too wet in the spring to be worked at the same time as the higher parts. This year, the whole garden was plowed from top to bottom by the 18th of April, and it worked up as mellow as an ash-heap. With the spring plowing, the ground was subsoiled. The subsoil plow, following in the furrow of the surface plow, worked

the soil about ten inches deep. This brought to the surface many large stones, which were removed, and eight or ten waggon loads of smaller ones were also picked off during the summer. In this way, the vegetable garden has been put into a much better condition for the cultivation of the various vegetable crops.

A rotation of crops in the garden we think quite as important as a rotation of crops on the farm. On account, however, of the greater variety of crops grown in the garden, some of which are grown only in small quantities, a systematic rotation of garden crops is more difficult to arrange. The advantage of a rotation has been clearly shown in the garden here in the case of onions, which are commonly supposed to improve by being grown repeatedly on the same ground. For the past twelve or fifteen years, it is said, onions have been grown here on the same ground, and year by year they have become smaller and smaller, until last year they would not average much more than one and one-half inches in diameter. This year they were grown on an adjoining piece of land, and given the same attention as usual, the results being that the bulbs are double the size they were last year. One of the men declared, "They are the finest onions I have seen here for the last nine years."

The rotation which we are trying to establish at present, is as follows :

1. Strawberries, a new plantation of which will be put out every spring, and cropped two years.

2. Potatoes, tomatoes and corn, gross feeders, which can readily make use of the decaying organic matter in an old strawberry bed.

3. The various garden crops grown for their roots or bulbs ; as beets, carrots, onions, parsnips, salsify and turnips.

4. The legumes and cucurbits ; as, peas and beans, cucumbers, citrons, melons and squashes.

5. Cabbage, cauliflower and celery.

This may have to be varied occasionally to suit the requirements, but a systematic rotation will be aimed at, and more fully carried out as soon as it can be definitely ascertained just what area will be necessary to grow a sufficiency of each kind of garden crop

The yield from the various garden crops this year, notwithstanding the severe drouth in the early part of the summer, was very fair—an ample supply to meet all the needs of the College.

The Lawn and Grounds.

Among the many duties devolving on this Department, is the care of the lawn and grounds. On account of their extent, considerable labor is required to keep these, at all times, in first-class condition. An effort has been made to do this, however, and we think we have been fairly successful. During the period of rapid growth, in spring and early summer, the horse and hand mowers were in constant use, to keep the lawn smooth and well shorn. The grass edges bordering the drives and flowerbeds were trimmed and kept neat. The soil about the trees and shrubs was repeatedly hoed and kept in a mellow condition. Fresh screened gravel was added to many of the drives, and these also were gone over frequently with the hoe and rake to keep down grass and weeds.

Every year considerable labor has been required to repair and fill up gullies washed in the sides of the drives during heavy rains. Some permanent improvement has been effected this year in the way of paving the east side of the main drive leading to the College. The paving is done with small cobble stones, and extends from the border two feet into the drive. This has proved effective as was shown after the heavy fall rains. The work will be continued next year, until all drives needing it will be done in like manner.

Another permanent improvement was the erection of a low, neat, wire fence between the lawn and north end of the vegetable garden. We do not, as a rule, believe in erecting fences, and have been endeavouring to do without them as much as possible. But

after a couple of serious inroads into the garden by the cattle of careless neighbors, we were obliged to do what no one in a Christian neighborhood should have to do—fence against our neighbor's cattle.

Much permanent improvement has also been made in the grounds surrounding the dairy and poultry buildings. In various places where it was required, they have been levelled and either sodded or seeded. The drives have been graded and gravelled and put in an attractive condition.

Arboretum and Tree-Clumps.

We have here on the College lawn and in the various tree-clumps scattered about the place, a very fine collection of the varieties of trees and shrubs which will thrive in this section. Much of the value of this collection, as a means of instruction, heretofore has been lost, because the trees have not been labelled. A start has been made this year towards supplying this need. Preparatory to securing labels, the trees and shrubs had to be identified, and a list made of the varieties growing. In some cases considerable difficulty has been experienced in doing this, on account of the scarcity of bloom this year, after the severe frosts of May. But as opportunity offered, the work has progressed, and a list as complete as could be made this year, has been prepared. Much valuable assistance in this work was given by Mr. D. W. Beadle, of Toronto, an experienced nursery man and botanist, who spent a week here helping us during the summer. The labels we intend using have to be ordered from London, England, and it is expected that they will be on hand ready for use next spring

In the spring about two hundred Austrian pines, which were becoming crowded in the nursery, were taken up and transplanted in the corners of the fields in various parts of the farm, so as to vary the landscape with clumps of evergreen.

The trees in the forestry plantation were trimmed and kept well cultivated during the season. Many of these were seriously checked by the late spring frosts ; but on the whole, they have made a very fair growth, and in a few years will so shade the ground that cultivation will be unnecessary.

The Greenhouses.

In last year's report we described at length our six different greenhouses, and gave an account of the work carried on in each. The work during the past year has been continued with increased vigor, and large additions have been made to our list of varieties.

The celluloid labels described in our report last year have stood well and have given good satisfaction. The work of labelling with these has continued as new plants have been introduced. Some of them may be seen in the illustration of chrysanthemum blooms.

Since we have had electric cars between the city and the College, there have been crowds of visitors every day to see the greenhouses. From the Guelph *Mercury* we clip the following account of a reporter's visit, at the time of the chrysanthemum display :

"In these days, when autumn has bereft Flora of her adornment in the garden and the fields, it is refreshing to look on her beauty in the conservatories. At this time the conservatories of the O. A. College are visited by hundreds of people from the city and surrounding country to gaze on the wealth of nature's beauty, garnered from every clime, which they contain. Under the guidance of Mr. Hutt, the Horticulturist, a reporter, on Tuesday afternoon, had the pleasure of spending an hour amidst the beauty and wealth of the conservatories.

The display of chrysanthemums is better this year than in any previous year. They have now over one hundred varieties, twenty of which are new varieties selected from the prize list of the chrysanthemum show at Toronto last fall. They have some of the largest and fullest blooms that they have yet grown. These are obtained by training to

a single stem, allowing only one or two buds to bloom. Some of the largest will measure about eight or nine inches in diameter. Recently a great deal has been done towards introducing the feathered and anemone-centred varieties, on account of their oddity and unusual beauty. A number of them are among the recent introductions. The shades and colors of these are innumerable and indescribable, and can only be appreciated when seen. The single stem blooms are now at their best, but the general display in the conservatory will be at its best in another week, when the bloom will last for four or five weeks. The grouping and arrangement of the flowers in the conservatory is tasteful and artistic, reflecting credit on Mr. Hutt, and his florist, Mr. James. The tall, graceful chrysanthemums at the back from a bank of bloom, set off by the smaller and variously tinted geraniums in the foreground. The palms and other tropical plants in the centre of the conservatory give a faint idea of a tropical forest.

In the tropical house a chief feature of attraction is a banana bearing a truss of fruit. These, when ripened on the tree, are much more juicy and appetizing than the dry, mealy ones picked green and shipped to us from the south. In this house, too, is also found a number of the economic plants, such as the cocoanut, the ivory-nut (from which ivory buttons are made), the coffee tree, pepper tree, sago palm, etc. There were also observed a number of nice orchids, but they have not yet attained full bloom.

In the intermediate houses are now being raised a host of vigorous plants which will keep up the succession of bloom after the chrysanthemum bloom is over. A large number of lily bulbs are rooting, which will make a fine display next Easter.

In the Horticultural Laboratory the plants are growing with which the students will carry on their experiments and laboratory work during the winter. Among these are a fine lot of strawberries coming into bloom. From these it is expected to produce by hybridizing, new varieties.

A whole forest of young geraniums, coleus, etc., are being started in the propagating house to make plants for bedding next spring.

In the forcing hours there is a beautiful collection of roses and carnations from which out flowers are obtained in the winter. Later on in the season this house will be devoted principally to the forcing of vegetables, such as radish, lettuce, cauliflower, and tomatoes, the space under the bench being utilized for growing mushrooms and rhubarb."

III. INSPECTION OF FRUIT EXPERIMENT STATIONS.

The system adopted last year, of testing both old and new varieties of fruits by means of fruit experiment stations in various parts of the Province, has this year assumed more definite form, and promises fully to meet the requirements of Ontario fruit growers.

It has been my pleasant duty to visit and inspect, during the summer, all of the stations already established. Each station was visited at the most opportune time for taking note of the particular kind of fruit grown there. At every station, I am glad to say, good work is being done, and valuable information is being gained, which will be given to the public in the annual report of the stations.

In company with Mr. L. Woolverton, Secretary of the Ontario Fruit Growers' Association, I also visited a number of other places in different parts of the Province, where it is thought desirable that other stations should be established, our object being to learn as much as possible about the fruit interests of these sections, and find competent fruit growers to undertake experimental work.

BOTANICAL LABORATORY AND GREENHOUSES.

STUDENTS PRACTISING HYBRIDIZATION IN HORTICULTURAL LABORATORY.

VIEW IN COLLEGE CONSERVATORY.

A FEW CHOICE CHRYSANTHEMUMS.

The following is a brief report on visits to the stations established last year :

The Wentworth Station.

May 23rd, 1895. Visited the Wentworth station, where Mr. Murray Pettit, Winona, is making a speciality of grapes. Found everything under good cultivation and well cared for. Spraying with copper sulphate solution had been done before the appearance of the foliage, and also with the Bordeaux mixture before the appearance of blossoms.

The severe frosts of the previous two weeks had killed the new growth on the young vines at the north end of the place ; the large vineyards, however, at the back and more under the lee of the mountain, had escaped with little or no injury. Pears and plums also at the front were seriously thinned out by the frost, while a block of one hundred greening apple trees, close under the mountain, was white with bloom.

The plot of ground devoted to the planting of new varieties, was in first-class condition and the young trees and vines were doing well.

September 25th. Visited Mr. Pettit again at the height of the grape harvest, when all hands were busy picking, packing and shipping grapes. In most parts of the vineyard, the vines were heavily laden and presented a magnificent sight. From the twenty acres in bearing, Mr. Pettit estimated the crop would be between sixty and seventy tons. This was being disposed of at the rate of about two tons per day, shipped mostly to regular customers or retail dealers in various parts of the province. In this way, Mr. Pettit realizes much better prices than by shipping to commission men in the large and usually over-stocked markets.

Owing to the light crop of fruit in all parts of the country, except where it was protected from frosts by the proximity of some mountain or large body of water, the prices this year are unusually good ; and fruit growers in such favored sections are making up for the low prices obtained in other years, when fruit has been abundant.

The South-Western Station.

September 26th. Visited the station at Leamington in Essex County, where Mr. W. W. Hillborn is making a specialty of peaches and strawberries. Our visit to this station last year was on the 15th of June, during the strawberry season ; this year we deferred it till September, to see it at the time of peach harvest.

Although peaches are grown to a certain extent all over this county, they are most extensively grown along a narrow ridge of land in the southern part of the county, running parallel with the lake shore. "The Ridge," as it is called, is about five or six miles long, and varies from half a mile to a mile and a half in width. The soil is a light, dry, sand, so dry in fact, that for the last two years, the strawberries growing on it have, in many cases, been killed out during the hot weather of midsummer. Its peculiar adaptability, however, for peaches makes it valuable, and in consequence of this being the only section in Ontario where the peaches were not injured by the spring frosts this year, the price of land along "The Ridge" has risen nearly $20 per acre.

Mr. Hillborn has about 100 acres planted with peach trees, and expects to put out twenty-five acres more next spring. As yet, most of the trees are young and not in bearing. From five acres bearing this year, he picked about 900 baskets, which were sold by contract for eighty-four cents per basket.

He has now under test over one hundred varieties, about forty of which will be bearing next year. Full reports as to the value and productiveness of these varieties will be given from year to year in the annual reports, so that valuable information for peach growers may soon be looked for from this station.

The Georgian Bay Station.

On August 29th, after a couple of days spent among the fruit growers about Walkerton and Port Elgin, and a sixty-mile ride across the country on a bicycle, we reached our plum experiment station at Clarkesburg. By taking note of orchards along the road, the influence of the waters of the Georgian Bay upon the climate in that section might readily be seen. In all of the orchards inland, and in many places up to within a mile or so of the shore, the spring frosts had destroyed the blossoms and there was little or no fruit. Along the bay shore, however, many orchards might be seen laden with fruit, and in some cases the branches were propped with poles to enable them to bear their load.

The orchards of Mr. John Mitchell, our experimenter at Clarkesburg, being a couple of miles from the bay, had suffered somewhat from the frosts, and were bearing about half a crop. The varieties of apples most heavily loaded were Kings, Baldwins, Ribston Pippins, Cayuga Redstreaks and Greenings. Northern Spies, had not bloomed at all. Duchess of Oldenburg, which were then all harvested, had been a good crop and had brought two dollars and fifty cents per barrel in St. Mary's and Stratford.

Plums, of which fruit Mr. Mitchell is making a specialty, were seriously injured by the frosts. Those varieties which had escaped uninjured and were bearing heavily, were Lombards and Duane's Purple. The fruit of these was finding ready sale at $1.25 per basket. Mr. Mitchell has about 500 thrifty young plum trees in bearing, and in the new plot devoted to variety tests, thirty-seven varieties were planted this last spring. Three trees of each. Besides these, he is testing a few of the hardier varieties of peaches, pears and cherries.

Mr. Mitchell is a thorough cultivator, sprays his orchards carefully for insects and fungous diseases, and takes a lively interest in the fruit industry of his section.

The Simcoe Station.

August 30th. Visited the Simcoe Station, where Mr. G. C Caston, of Craighurst, is testing hardy varieties of apples, pears and cherries, and some of the small fruits. Craighurst being somewhat inland, the fruit in this section was seriously injured by the spring frosts. In Mr. Caston's apple orchard there was about a quarter of a crop. The varieties bearing most heavily were: Wealthy, Spitzenburg, Baxter, Golden Russett and Talman Sweet. Some young Wealthy trees were very heavily laden, proving the hardiness and productiveness of this variety.

Good cultivation and thorough spraying, such as Mr. Caston gives his orchard, may accomplish wonders in most seasons in producing fine fruit, but in seasons like this where the frost takes everything, cultivation and spraying can avail nothing, except to keep the trees in a vigorous, healthy condition for future crops. It was on account of the scarcity of fruit in Mr. Caston's orchard this year, that he was unable to make the display at the Toronto exhibition which he otherwise would have made.

Among his young apple and pear trees planted this spring there was not a failure, all of them at the time of our visit showing a good growth. The currant and gooseberry bushes planted this spring were also doing well. Mr. Caston has yet a number of Russian varieties in the nursery row, ready for planting another year.

The Bay of Quinte Station.

September 4th. We arrived at Trenton, and after wheeling out four miles on an uphill dusty road, we reached the home of Mr. W. H. Dempsey, the manager of the fruit experiment station for this section. Mr. Dempsey's specialty is apples. His orchard covers about forty acres; nearly all of the trees of which are in bearing. Mr. Dempsey and his father, the late P. C. Dempsey, always had a taste for originating and

testing new varieties, and, on this account, Mr. Dempsey's orchard probably contains a greater number of varieties than any other apple orchard in Ontario. He has growing over 150 varieties, twenty-three of which are carefully described and reported on in last year's report.

The spring frosts, so injurious in most places, had done very little damage here. It was estimated that his crop would be over 1,500 barrels, and, as most of the apples this year are of unusually good quality, the greater part of the crop will be A1 marketable fruit.

To enable him to pack and ship his fruit to advantage, Mr. Dempsey has built a large, two-story fruit house, the walls of which have been made frost proof, so that apples may be stored in it all winter and sold in the best markets.

"Maplehurst" Fruit Farm.

When giving an account of visits to the different fruit experiment stations already established, and which we expect in time to contribute valuable information to Ontario fruit growers, it may be well to mention "Maplehurst," the fruit farm of Mr. L. Woolverton, Secretary of the Ontario Fruit Growers' Association and editor of *The Canadian Horticulturist*; for probably no other fruit farm in the province has afforded so much information to fruit growers as that of the editor of *The Horticulturist*. "Maplehurst" is about a mile west of the village of Grimsby, and consists of a one hundred acre strip of land about a mile long, running from the mountain to the lake. It embraces a great variety of soils, from a light, loamy sand to a heavy clay. This, in connection with the wonderfully favorable climate and shelter of the mountain, makes it well adapted to the production of all kinds of fruits grown in the province, and all of these are grown there more or less extensively, as the entire farm is planted with fruit.

Besides growing fruit for profit, Mr. Woolverton plants largely every year as a student of horticulture. Nearly every new fruit promising to be of any value is given a trial. Last spring about 130 new varieties were planted, embracing pears, peaches, plums, apricots, cherries and grapes. By planting annually in this way and keeping careful records, Mr. Woolverton, as editor of *The Horticulturist*, is enabled to advise his readers with authority as to the merits of new fruits constantly being brought before the public. His collection of varieties of cherries is one of the largest in the Province, and it is hoped we may glean valuable information from his reports on these.

Proposed New Stations.

The following notes are on visits made to different persons, with a view to finding suitable places for new stations:

Martin Burrell, St. Catharines, Lincoln County.

Visited May 25th, 1895. Situated four miles west of St. Catharines and half a mile from the lake. Farm of twenty-five acres, seventeen acres in fruit. Soil very variable, from light loam to heavy clay, partly rolling. The following fruits are being grown: Four acres or about 1,000 peach trees in bearing, of twelve varieties; two acres peaches newly planted; 200 pear trees, mostly in bearing, of twelve varieties; 150 cherry trees, six varieties, mostly early Richmond; fifty quince trees, of two varieties; 800 grape vines, about twelve varieties; about half an acre of strawberries and other small fruits; few apples.

Mr. Burrell is an energetic young man, enthusiastic in fruit growing. He takes an active part in the local farmers' institutes, and has made for himself a reputation as a thorough going fruit grower.

STANLEY SPILLET, NANTYE, SIMCOE COUNTY.

July 9th, 1895. Three miles north of Lefroy station and twelve miles south of Barrie.

Lot of two and a half acres, but more can be bought from an adjacent farm.

Soil, a moist, sandy and clay loam, well adapted to growing gooseberries. Land all well underdrained, heavily manured and thoroughly cultivated.

The following fruits are grown: gooseberries, raspberries and strawberries, and a few trees of plums, pears and cherries. Most of the ground is devoted to growing gooseberries, of which he has about 700 bushes of about twenty different varieties. A plot of new varieties put out this spring.

His Champions were remarkably prolific and his Downings very large. All had been sprayed. Mr. Spillet uses a small Clarksburg pump on a barrel mounted on a hand cart. Has also used flowers of sulphur for mildew. His bushes are planted six by four feet and trained in the bush form.

Mr. Spillet is an elderly man and has taught in the neighboring rural school for thirty years, but is resigning this year. He is a careful, reliable man, enthusiastic in gooseberry growing, and should make a good experimenter. Was busy when we called making drawings of the different varieties of berries.

He grows plants every year for E. D. Smith of Winona.

REV. E. E. STEVENSON, FREEMAN, HALTON CO.

Mr. Stevenson is a Methodist minister, now stationed at Freeman, near Burlington. Nearly all of his strawberries, however, are grown on the fruit farm of his father near Guelph, which he visits frequently. Mr. Stevenson has all his life been growing and testing everything new in the line of strawberries, and is without doubt the best authority in the Province on the varieties of this fruit. He has about two hundred varieties under test, forty-two of which were reported on in last year's report. He is also giving attention to the production of new varieties by artificial pollination.

A. E. SHERRINGTON, WALKERTON, BRUCE CO.

August 27th, 1895. Short distance from G. T. R. station, outside town limits, on land 160 feet above the town. Has a farm of seven acres, but expects to buy more. Soil chiefly clay loam and uniform. Most of the farm planted with apples and plums. Has about 240 apple trees in bearing, seven or eight of the leading varieties. Some of the newer varieties top-grafted. Plums, about forty-five trees, about twelve varieties. Pears, about thirty-five trees, mostly Bartlett, Flemish Beauty and Duchess. About half an acre in strawberries and raspberries.

Mr. Sherrington is an intelligent, progressive man; and, being an apple buyer, is well acquainted with the fruit interests of his section. He says that in 1893 about 40,000 bbls. of apples were shipped out of that section. He has also a large apiary managed according to modern methods.

A. W. PEART, B.A., BURLINGTON, HALTON CO.

August 31st. Farm about one and a quarter miles east of Burlington station and about one and a half miles from lake shore. One hundred and fifty acres of land, twenty of which are in fruit. Soil variable, from a gravel to a clay loam.

There are under cultivation the following fruits:

Apples. Ten acres, 400 trees, twenty-eight varieties, mostly in bearing.

Pears. Three hundred trees, about eight varieties of young trees coming into bearing.

Grapes. Three acres, twenty-two varieties, just in bearing.

Peaches. Fifty trees, three varieties.

Plums. Six acres, twenty varieties, young or coming into bearing.

Currants. One acre, six or eight varieties.

Other small fruits grown for home use.

The whole farm and all the fruits are under first-class cultivation. Mr. Peart has been spraying for the past ten years, and his trees and vines are nearly all well loaded with a fine crop of fruit.

Personally Mr. Peart is a man of exceptional qualities. He is a graduate of Toronto University, and is a progressive and very energetic fruit grower. He is a careful observer and an exact experimenter on his own account. He is public spirited and posted in the fruit interests of his locality. He is at present Secretary of the Burlington Horticultural Society, which he helped to organize, and President of the County Farmers' Institute.

The Burlington district is one of the leading fruit districts of the province, and has carried off the prize for district exhibition from Toronto for a number of years. At the time of the World's Fair at Chicago, this district contributed largely to the grand display of fruit made by Ontario. The fruit sent from Burlington to Chicago was gathered and shipped at the expense of the local Horticultural Society.

R. L. Huggard, Whitby, Ontario Co.

September 3rd. Farm about half way between the town and G. T. R. station.

Property in two blocks of ten and twenty-five acres, some distance apart. The ten-acre block is nearly all in fruit, and he expects to buy more land adjoining. Soil, a clay loam, uniform and well drained.

The following fruits are being grown .

Apples, about 100 trees in bearing and a number of young ones coming on, about forty-five varieties, generally two trees of each variety.

Pears, about 400 trees, mostly six years old and coming into bearing, others newly planted, about fifty varieties.

Plums, about three hundred trees, most of them coming into bearing and some older, about fifty varieties.

Grapes, about thirty varieties, one or two vines of each, not very profitable in this section.

A few small fruits, such as currants, raspberries, etc.

Orchard under fair cultivation and well sprayed with Bordeaux and kerosene emulsion. Some trees top-grafted. Mr. Huggard is of about middle age, enthusiastic in fruit growing, intelligent and energetic. Acts as agent for Messrs. Stone & Wellington.

E. C. Beeman, Newcastle, Durham Co.

September 3rd. Farm one and a half miles west of Newcastle and three miles east of Bowmanville. Sixty-eight acres of land bordering on the lake. About twenty acres in fruit. Soil, a rather heavy clay loam, draining toward the lake.

The specialty at this place is pears. Of these Mr. Beeman has about thirteen acres, mostly in bearing. He has some of the largest pear trees to be found in the country. Some old Flemish Beauty trees will yield this year six or eight barrels each.

He had growing at one time nearly 250 varieties of pears, but many of these blighted, and he has now about 150 varieties, and generally three or more trees of each variety.

Apples, about thirty varieties, 150 old trees and about 270 younger trees coming into bearing. Many of them top-grafted with new varieties.

Plums, about 200 trees, newly planted, of fifty varieties.

Grapes do not succeed well here, but he has about thirty varieties, two vines of each.

Small fruits only for home use.

Mr. Beeman is a man of about sixty years of age. A very careful, thorough and painstaking fruit grower, well read and posted in the fruit industry generally. Has been spraying for the past ten years. The effects of spraying were very marked on his large Flemish Beauty pear trees. Sprayed trees were loaded and perfectly clean. On an unsprayed tree close by the fruit was cracked and covered with scab.

His young orchards Mr. Beeman keeps well cultivated, but his older pear trees are kept in sod to avoid blight. The grass is mowed and left as mulch and the ground manured as well.

Nearly all of his trees are loaded with fruit, which he grades properly and ships to Montreal in barrels.

HAROLD JONES, MAITLAND, GRENVILLE CO.

September 5th. Two miles from Maitland, seven miles east of Brockville and five west of Prescott. Farm consists of 265 acres, bordering on the St. Lawrence river. Soil, clay and clay loam, best along river front, somewhat rocky at the back of place.

Mr. Jones has about six acres of apple orchard, four acres of trees thirteen years old, nicely in bearing. Had 400 barrels grown this last year.

Two acres of old orchard rather rough. One hundred and seventy-five new trees put out last year. Altogether about fifteen varieties. The greater portion of the trees are Fameuse.

Bearing orchard is kept in sod and manured heavily. Has been sprayed carefully with Bordeaux mixture.

Mr. Jones is about thirty-five years of age, intelligent and enthusiastic in fruit growing. Visits Mr. Craig, of Ottawa, every year and keeps posted as to insect enemies; is fighting the case bearer in his orchard under the direction of Mr. Fletcher. He is public spirited and holds office in a number of benevolent societies.

IV. CO OPERATIVE FRUIT TESTING.

In connection with the Experimental Union, we have been sending out, during the past two years, a number of varieties of small fruits for co-operative testing. The following is a list of the tests undertaken this year:

Strawberries—Wilson, Bubach No. 5, Williams and Bederwood—twelve plants of each.

Raspberries—Marlboro', Cuthbert, Shaffer's Colossal and Golden Queen—six plants of each.

Black raspberries—Souhegen, Gregg, Palmer and Tyler—six plants of each.

Currants—Fay's Prolific, Victoria, Raby Castle and White Grape—three plants of each.

Gooseberries—Houghton, Downing, White Smith and Industry—three plants of each.

The supply being limited, twenty lots of plants were sent out for each of the five tests. As yet no results can be given. A further account of the work, however, will be found in the Experimental Union Report at the end of this volume.

V. BULLETIN.

The following bulletin was prepared at the request of a number of the fruit growers of York Co., and was published as a special bulletin from the Department of Agriculture, Toronto.

Planting and Caring for Young Trees in an Apple Orchard.

One of the first requisities to successful orcharding is to begin well. This bulletin briefly outlines for the guidance of intending planters some of the chief points which should be considered.

Location and Exposure. In selecting the site for an orchard, two of the main things to be sought for are exemption from late spring and early autumn frosts, and shelter from the prevailing high winds. The locations least subject to injurious frosts are those bordering on large bodies of water, and, in the interior, the high lands. It is important to plant apple trees on the highest land available. If the elevation is not more than ten feet above the general level of the adjacent land, it affords an advantage in allowing the cold air to sink into the lower levels, and lessens the danger from frosts, which often do great injury when the trees are in bloom. One of the worst locations is a sheltered valley in which there is little or no circulation of air, and into which the sun shining makes it the hottest spot during the day, and the cold air settling into it from the higher elevations, makes it the coldest spot during the night.

A free circulation of air is very desirable in an orchard, and a full exposure is better than shutting it in too closely, yet it is advisable to have an orchard somewhat sheltered from the full force of the prevailing winds. These, in most parts of the country, come from the southwest. The shelter therefore should be on on that side, and may consist of a strip of woodland, or a belt of Norway spruce put out at the same time as the orchard, or better than all, would be to have the orchard planted on a hillside having a northern or northeastern exposure. Such a location and exposure is least subject to sudden changes of temperature, drouth, and the prevailing high winds.

The Soil and its Preparation. Apples may be successfully grown on a great variety of soils, from a moderately light sand to a heavy clay. The best soil, however, is a deep, open, clayey loam, which should be well drained either naturally or artificially, In addition to this, it should be moderately rich and retentive of plant food, for it is impossible to raise good fruit on poor soil.

To prepare the land for planting, it should be plowed deeply in the fall and put in good condition in the spring, as if prepared for a hoed crop. If the subsoil is a hard clay into which the roots of the trees cannot readily enter, it should be loosened by means of a subsoil plow. When it is not convenient to prepare the whole ground in this way, do a strip at least five or six feet wide where each row of trees is to stand ; or, when planting, dig the holes much wider and deeper than would be otherwise neccessary for planting.

Distance Apart for Planting. It is impossible to state any particular distance apart for planting, which would be suitable for all conditions. The rule should be to allow space enough so that when the trees are full grown, the tops will yet be a few feet apart. This allows the free admission of sunlight, so neccessary in producing well colored fruit. The ultimate size of a tree will depend much upon the variety, and the soil on which it is grown. Varieties such as the Ben Davis of Ontario, for instance, require much less room than large growing varieties, such as the Greening or Baldwin, while a tree of any given variety will grow much larger or smaller than usual according as it is grown on richer or poorer soil. The best guide to intending planters is to observe the distances apart of full-grown thrifty trees in the neighborhood. These will be found to vary with different varieties in different sections all the way from twenty-five feet in the case of the smaller growing varieties to forty feet in the case of those varieties that spread. The average distance will be about thirty feet. It will be better to keep them a little too far apart rather than too close together.

Arrangement of Trees. There are several methods of arranging the trees in an orchard. The one usually adopted is the square; most used no doubt because many do not know of a better. By this arrangement, the trees are planted in rows the same distance apart each way, four trees forming a square. A much better plan is what is known as the hexagonal. By this system fifteen per cent. more trees can be grown per acre without the least bit more crowding—no small item when we consider that the profits per acre are increased accordingly. By the hexagonal arrangement, the trees in the second row are set alternating with those in the first; six trees forming a hexagon and enclosing a seventh in the centre. To ascertain the correct position for the first tree in the second row, and consequently the distance apart of the rows that way in the orchard, take two strings the same length as the distance apart at which the trees are to be planted, fasten the end of one to the first and that of the other to the second stake in the first row, then stretch the free ends out till they meet, and this point will mark the position for the first tree in the second row.

Whichever method of arrangement is adopted, the trees should be set in perfectly stright lines, the first tree, no matter which way we look, hiding every other tree in the row Crooked rows are not only an eyesore; but, during cultivation, they endanger the lives of the trees, as well as the morals of the man who has to cultivate them. To assist in getting the rows straight, the position of each tree should be marked by a little stake before the holes are dug. Then, when planting, use a "planting board." This may be five or six feet long and six inches wide, with a notch in one side at the middle, just large enough to let in the trunk of a small tree, and a hole at each end at equal distances from this notch. When a hole is to be dug place this notch about the stake and put a peg through each hole at the end. The board may then be taken up and the hole dug. When the tree is to be planted, replace the board over the pegs and place the tree in the notch. It will thus stand in exactly the same position as the stake which marked the hole.

Fertilization of Blossoms. That the blossoms of a tree may "set" or become fruit, they must be fertilized with pollen from their own or some other tree. It has long been known, however, that nature abhors self-fertilization, and that she resorts to various modifications of the flower to prevent it and thus secure if possible cross-fertilization. Bees and other insects flying from flower to flower are the chief agents in distributing the pollen and bringing about cross-fertilization.

In accord with this, many varieties of apples have been found to be more or less self-sterile—that is, their pollen does not properly fertilize their own blossoms, although it may be quite potent on the blossoms of some other variety. Recent experiments conducted by the United States Department of Agriculture have clearly shown this to be the case with many varieties of pears and even those varieties which are self-fertile were found to bear larger fruit and more of it, when fertilized with pollen from some other variety.

In planting an orchard, therefore, while it is well to avoid planting a multiplicity of varieties, yet it is important to avoid planting too large a block of any one variety.

Transplanting. There is quite a diversity of opinion as to the proper time for planting trees. It may be done in either spring or fall, when the tree is dormant. As a rule, however, planting in early spring is the safest in our climate.

If, when the trees arrive from the nursery, it is not convenient to plant them at once, they should be "heeled in" by placing the roots in a trench and covering them with mellow soil, well packed, to prevent their drying out. Never allow the roots to be exposed to the sun or wind any more than can be helped.

No matter how carefully a tree has been taken up, its roots are always more or less mutilated and broken. All such injured roots and broken ends should be cut back with a smooth cut to sound wood. That a newly planted tree may flourish, it is necessary that a balance should exist between the roots and tops of branches, consequently when transplanting, the tops should be cut back to correspond with the roots that remain.

The whole should be dug wide enough to allow the roots to be extended freely in all directions, and deep enough, that, after a few inches of surface soil have been filled into the bottom, the tree will then stand about the same depth as it stood in the nursery. Spread the roots out carefully in their natural positions and cover them with moist, mellow surface soil. When the hole is about half filled, get in and tramp the earth firmly about the roots. Omitting to do this is one of the most frequent causes of failure in transplanting. If watering is necessary, a pailfull may then be added, but this is seldom necessary except in a very dry time. The remainder of soil being filled in and tramped firmly ; a couple of inches on top should be left loose and untramped. This acts as a natural mulch, checking the evaporation of moisture from below.

Mulching. When the tree is planted, spread around it as far as the roots extend, or a little beyond, a five or six-inch covering of coarse stable manure, or other loose material which will act as a mulch. This is particularly necessary in a dry soil or in a dry season. It prevents baking and cracking of surface soil and consequent escape of soil moisture from below, and at the same time maintains a uniformity of heat and moisture which is highly favorable to the formation of new roots.

Cultivation and Cropping. One of the most important factors in determining the profits from an orchard, is good cultivation. Sod should never be allowed around young trees. For the first five or six years, some hoed crop, such as roots, potatoes, beans, or corn, may be grown in the orchard. The cultivation required to grow these profitably will keep the ground in good condition for the trees, while such crops will yield a return from the land until the trees themselves begin to bear. Never sow a grain crop in a young orchard, unless a strip, at least as wide as the height of the trees, is left on each side of the rows and kept well cultivated.

The roots of a tree generally extend as far below the ground laterally as the top spreads above it, and they should be the sole occupants of the ground as far as they extend. Cropping between the rows, therefore, must gradually decrease as the trees increase in size, and should be discontinued altogether as soon as the trees fully occupy the ground.

Cultivation about the trees should never be so deep as to interfere with the roots. Shallow, level cultivation is much safer than plowing. By using the spring-tooth cultivator to loosen the ground, and the broad-share cultivator to keep the weeds down, plowing may profitably be dispensed with altogether.

Cultivation should commence in the spring as soon as the ground is fit to work, and be continued as often as necessary until about the middle of August. If cultivation is stopped at that time, the trees are more likely to stop growing and ripen their wood, so that it will not be injured by severe freezing. The frequency of cultivation necessary will depend much upon the soil and season. The aim should be to keep the surface soil loose and open, so that it will act as a natural mulch and enable the trees to withstand the injurious effects of drouth at any time.

Manuring. Manuring an orchard in order to obtain good crops of fruit is often just as necessary as manuring a field to get a good crop of corn or roots. In a young orchard, where hoed-crops are grown, the manure applied to grow these profitably will be all that is required by the young trees, as they will get their share of it. The vigor of the hoed-crop will be a good indicator of the quantity of manure necessary for the trees. In older orchards, where there is no cropping, the annual growth of the new wood is the best guide in applying manure.

As a general fertilizer, nothing is better than barnyard manure, but should be withheld where the new growth is excessive or where the wood growth is at the expense of fruit.

Unleached wood ashes are a specific fertilizer for fruit trees, as they contain all the inorganic elements necessary to produce both tree and fruit. Unlike barnyard manure, they tend to promote fruitfulness rather than excessive wood growth, and may safely be applied at any time.

In applying fertilizers of any kind, never bank them about the trunk of a tree, but spread them evenly all over the ground as far out as the roots extend.

Pruning. One of the first things to be considered in pruning a young orchard is the height at which the heads should be started. Some prefer low heads, and others high heads. Either extremes should be avoided. From four to four and a half feet is a convenient height for apple trees To have them all like, cut them back to the desired height when young. Three branches are enough to leave to start the head. Space these evenly, and direct new growth whenever necessary by cutting back to a bud pointing in the direction you wish the new branch to take. The ideal pruning consists rather in directing growth than in cutting out what has grown. Thin out the new shoots as may be required, to keep the head from becoming too crowded. Cut out any branches that cross or rub each other, and keep the top symmetrical by cutting back branches growing too fast in any particular direction, as they are often inclined to do on the leeward side.

If an orchard is pruned regularly every year, as it should be, there need be no necessity for cutting out large limbs, and the pruning at any time will be very light. Light pruning may be done at any time during the summer, but for the general, annual pruning, this had better be done early in spring before the growth starts.

Protecting the Trunks from Borers. One of the most destructive insects to newly transplanted trees is the flat-headed apple-tree borer. The mature insect is an active little beetle, nearly half an inch long, which lays its eggs on the bark of the trees, generally on the southwest side. When the eggs hatches, the larva eats its way through the bark and feeds upon the sap-wood, sometimes entirely girdling the tree. When full grown, it is a pale, yellow, footless grub, over half an inch long, with a large flattened head. The presence of these pests in infested trees may readily be detected by the blackened and deadened appearance of the bark over the parts where the borers are at work.

When borers get into a tree, there is no other remedy than cutting them out with a sharp knife, or killing them in their burrows with a stout wire. But prevention is better than remedy, and the injury from borers can easily be prevented. To do so, wash the trunks and larger branches with a mixture of soft soap reduced to the consistency of thick paint with a solution of washing soda. If just enough carbolic acid is added to give it a strong smell, it will be all the more repulsive to the beetles. This should be applied during the early part of June and again early in July when the beetles are most active in laying their eggs.

Spraying. The whole host of leaf-eating insects which feed on the apple tree, such as the Tent caterpillar, Red-humped apple tree caterpillar, Yellow-necked apple tree caterpillar, Fall web worm, Tussock moth, canker worms, etc., must be fought with Paris green, used at the rate of one pound to 250 gallons of water.

Other insects which suck the juices from the leaves and young wood, such as the aphis, tree cricket, and bark louse, must be destroyed by the kerosene emulsion. This is made according to the following formula: Hard soap half pound (or soft soap about half gallon), hot water one gallon, coal oil two gallons.

Dissolve the soap in the hot water, add the coal oil, then agitate by means of a force pump or syringe for five or ten minutes, until thoroughly mixed. If properly made, this, on cooling, will form a jelly-like substance, which, before using, should be diluted with about fifteen parts of water.

The apple scab fungus, which affects the foliage as well as the fruit, must not be allowed to weaken the young trees before they come to a bearing age. To hold this in check, spray before the buds open with a solution made of one pound of copper sulphate to twenty-five gallons of water; after the foliage appears, spray three or four times at intervals of ten days or two weeks with the Bordeaux mixture. This, as now used, is made according to the following formula: Copper sulphate (blue vitrol) four pounds, lime (fresh) four pounds, water fifty gallons or one coal oil barrel.

Dissolve the copper sulphate in a wooden vessel, or in the barrel on which the force pump is mounted. To do this quickly, hang it in a little cotton bag so that it will be just

below the surface of the water in the barrel. In another vessel slake the lime, using plenty of water, then strain it through a bit of coarse sacking into the barrel containing the copper sulphate. Fill the barrel with water. If the lime is fresh and pure, it should neutralize all the acid in the copper sulphate solution. To test if this be the case, add to a small sample of the mixture a drop or two of ferrocyanide of potassium. If the lime is insufficient, this drop, when added, will turn brown. In that case, lime-water must be added until the test gives no brown coloration:

The Bordeaux mixture and the Paris green may with advantage be applied together, thus forming a combined fungicide and insecticide. To do so, add four ounces of Paris green to a barrel of the mixture.

All of these mixtures should be applied in the form of a very fine spray. The "Vermorel" and "McGowen" nozzles have so far been found to be the most effective and economical for this work. These may be attached to any good, strong force pump, of which a number of Canadian makes may be found advertised in the agricultural and horticultural journals.

Summary.

1. For an orchard, select, if possible, high land with a northern or northeastern exposure.

2. A well-drained, deep, open, clayey loam is best.

3. Work the land deeply and well previous to planting.

4. Plant far enough apart that trees will not touch when full grown.

5. The hexagonal arrangement of trees in an orchard admits of fifteen per cent. more trees per acre than on the square, without any more crowding.

6. To secure proper fertilization of blossoms, avoid planting together too large a block of any one variety.

7. When transplanting, keep roots moist and pack the earth about them firmly.

8. A mulch spread about newly transplanted trees maintains a uniformity of temperature and moisture favorable to the formation of new roots.

9. Give thorough, shallow, level cultivation.

10. Cropping between the rows must gradually cease as the trees increase in size.

11. Unleached wood ashes are one of the best fertilizers for fruit trees of all kinds.

12. Like all other fertilizers, they should be spread evenly as far out as the roots extend.

13. Prune regularly every year and direct growth rather than cut out what has grown.

14. Prevent injuries from borers by coating the trunks of trees with a soft soap, soda, and carbolic acid wash.

15. Spraying is often necessary on young trees, while not yet of a bearing age.

16. For leaf-eating insects, use Paris green; for sucking insects, kerosene emulsion; and for fungous diseases, copper sulphate solution and Bordeaux mixture.

17. The Bordeaux mixture and Paris green may be applied together with advantage.

VI. MEETINGS ATTENDED.

During the month of January, I attended farmers' institute meetings, and gave addresses on horticultural topics in fourteen localities in that portion of the Province known as Institute Division No. 8, as follows: Blackstock, Tamworth, Centreville, Napanee, Stella, Shannonville, Wellington, Demorestville, Grafton, Cobourg, Coldsprings, Orono, Salina, and Bowmanville.

Besides these, I attended also a farmers' institute meeting at Hespeler, and the annual meeting of the Ontario Fruit Growers' Association held at Woodstock.

Acknowledgments.

I beg gratefully to acknowledge the following donations to the Horticultural Department:

Mr. G. M. Beynon, Temperanceville, Ont. Australian tree seeds.

Goold, Shapley, Muir Co., Brantford, Ont. Spraying pump.

Mr. John Little, Granton, Ont. Strawberry plants.

Holmes & Holladay, Clarksburg, Ont. Spraying pump.

Mr. John Wells, Galt, Ont. Collection of varieties of begonias and coleuses.

Mr. E. G. Whiting, Cedar Dale, Ont. Dust gun.

Mr. G. H. Caughell, Aylmer, Ont. Strawberry plants.

Mrs. Jas. Munro, Thorold, Ont. Acacia seeds.

Mr. F. W. Hodson, O. A. C., Guelph, Ont. Seeds of North-West fruits.

Mr. P. B. Smith, Bermuda. Bermuda plants and seeds.

Miss Stannard, Guelph, Ont. Collection of tulip bulbs.

Prof. Saunders, C. E. F., Ottawa, Ont. Collection of fifty varieties of geraniums.

It gives me pleasure also to make mention of the efficient services rendered this Department by William Squirrel, gardener, and foreman of the outside work; and by Arthur James, florist, and foreman in the greenhouses.

Respectfully yours,

H. L. HUTT,
Horticulturist.

Ontario Agricultural College
Dec. 31st, 1895.

PART IX.

REPORT OF THE BACTERIOLOGIST.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit herewith my first annual report.

In the month of January last, I received instructions from the President to visit the bacteriological laboratories of a number of universities in the United States. In compliance with this request, I first went to the University of Chicago, where Dr. Jordan, Professor of Biology, kindly showed me his laboratories and equipment, and explained that most of the bateriological work in that institution had relation to sewage, water and general hygienic problems. Leaving Chicago, I went to the University of Wisconsin, at Madison, where I stayed for about a week. Dr. Russell, Bacteriologist of that institution, gave me permission to attend his classes and practical demonstrations in pasteurizing and general lacteal bacteriology. The Professor intends to give special attention to dairy bacteriology ; but class-room work at present engrosses most of his time. I gathered much information during the short time I remained, and then left for Wesleyan University Middletown, Conn., the seat of Dr. H. W. Conn's labors. The Doctor gave me an outline of his work and methods, and also the history of his now famous organism, Bacillus No. 41, a germ with which he claims to make butter of specially good flavor and keeping quality, without previous bacteriological treatment of the cream. On leaving Middletown, I paid brief visits to the Laboratories of Harvard and Yale, where bacteriological work of a general character is done. At the Harvard Medical School in Boston, extensive research is being carried on in medical bacteriology.

On returning, I had to wait some time for our pasteurizing apparatus, which had been ordered at Fort Atkinson, in Wisconsin. On its arrival a room was fitted up in the large dairy building, a short course of six lectures was delivered on the subject of dairy bacteriology, and practical instruction was given in pasteurizing milk and cream. The principals and scientific outline given in the lectures being thus practically illustrated in the work-room ; but on account of insufficient material and lack of room, it was impossible to demonstrate to the students fully and as satisfactorily as would have been possible, had the proper laboratory facilities been at hand. Now, however, we have a new bacteriological laboratory, equipped with everything necessary for illustration and demonstration in the work of this important department of scientific research.

Chicken Cholera. During the month of March, Mr. Jarvis, the poultry manager, was much troubled with diarrhœa among his fowls. From the spread of the affection throughout one building, he was led to believe that it was contagious. He submitted the matter to me, and by careful examination of the fresh droppings, I succeeded in isolating a germ whose cultural characteristics were identical with those of the bacillus of chicken cholera (Pasteur). On further investigation, I discovered the same germ in the liver of a fowl which had died of the disease.

The germ isolated was short, with rounded ends, the poles staining more intensely with aniline colors, giving the germ a dumb-bell like appearance. The bacillus was found in the blood organs and excreta of the fowls.

The fowls affected, appeared dull and drowsy, the feathers were ruffled; and unless prompt measures were taken, death followed very quickly. On post-mortem examination, *hæmorrahagic duodenitis* was found and bacilli present as well as in the viscera. The birds affected were isolated and the pens were disinfected with carbolic acid. For treatment, etc., of this malady, see the report of the poultry manager.

GRASSES OF ONTARIO.

During the spring and early summer, our agriculturist, Mr. G. E. Day, and I spent some time in preparing a bulletin on grasses, which, it is hoped, will be of benefit to farmers and others throughout the province. The following reprint is included in this report for the information of those who did not get a copy of the original:

Introduction.

No one will question the correctness of the statement, that grasses are amongst the most useful plants grown on the farm; and there is no doubt that farmers should study them carefully and learn all they can about those which are suited to their different localities and to the particular branches of agriculture in which they are respectively engaged.

Ordinary works on botany say very little about grasses, and the great majority of young men know still less about even the most common varieties. Hence Messrs. Harrison and Day have prepared this bulletin and are sending it out in the hope that a considerable number of the young farmers of this Province may use it so as to get an exact and thoroughly practical knowledge of those grasses which may be grown in their respective localities.

The popular portions of the bulletin are very simple and can be easily understood by all readers, and the more scientific descriptions introduced in connection with the illustrations, are intended for use in Public and High Schools and for the guidance of young men who may be disposed to study the grasses closely, so as to become familiar with the form, name, and uses of each variety. James Mills, President.

A Brief Description of the Parts of Grasses.

Roots. The roots of grasses are usually *fibrous*; and the fibres of which they are composed extend downwards into the ground to a greater or less depth. The deeper they go, the better the plant withstands drouth and the more it impoverishes the soil. Sometimes the roots, being very numerous and very much branched, bind the soil into a matted turf; at other times, they creep along beneath the surface (are described as *creeping*) and throw up underground shoots, which root themselves, send up stems, and form new plants. These latter are very difficult to eradicate and are apt to become a nuisance. Hence it is not advisable to grow them unless they produce an exceptionally large quantity of nutritious food. Couch grass (*Agropyrum repens*) furnishes a good example of this undesirable kind.

Stems. The stems of grasses that rise above the ground are usually hollow and are technically called *culms*. These stems are generally cylindrical, as well as hollow; but they are sometimes compressed and flattened, as in the case of Canadian Blue Grass (*Poa compressa*) and a few others.

Further, the stems of grasses are divided at intervals by thickened. solid portions called nodes, or joints. These were formerly supposed to strengthen the stem ; but; according to Hackel, their sole function is to lift up stems that have been beaten or trodden down The leaves, and sometimes the branches, start at these points.

The stem of grasses is divided by Lindley into three parts : (1) The lower part, which is procumbent and produces roots, but is itself distinguished from true roots by bearing scales and sending out not only roots, but underground branches called *rhizomes*, or *root stocks;* (2) the stem proper ; and (3) the upper part (where the spikelets are attached) called the *rhachis.*

The stem often has at its base a bulbous formation, which contains a store of food to be used by the plant when specially required ; as, for instance, in time of drouth.

The stem may be what is known as *erect*, *ascending*, *bending*, *decumbent* (reclining on the ground but rising at the top), *leafy*, when the leaf sheaths close around it, or *naked*, when there are no leaves on the upper portion.

The *rhachis*, or upper part of the stem, is described as *simple* or *branched*, *round* or *angular.*

Leaves. All leaves of grasses consist of two parts, the *blade* and the *sheath* ; in a few tropical species, a *petiole*, or leaf-stock is also found. The upper part of the leaf is called the blade. It is long and narrow, with parallel edges, and is described as *linear.* The lower part, which folds around the stem, is called the *sheath.* It usually extends round so far that the two edges overlap each other ; and, as it matures more quickly than the stem, its stiffer tissues serve as a protection to the culm in the earlier stages of its growth.

At the point of union between the blade and the sheath, there is often a small, thin, scale-like, membranous organ, called the *ligule.* It is a prolongation of the sheath ; it always lies very close to the stem ; and Schlechtendahl has suggested that its function is to keep water from getting in between the sheath and the stem.

The length and breadth of the blade vary considerably. Very narrow blades, such as those of Sheep's Fescue, are described as *awl-shaped ;* and comparatively broad ones, as in ribbon grass, are spoken of as *sword-shaped.* In some instances, the apex of the leaf is *acute ;* in others, *tapering* or *blunt.*

There is one central rib running down the leaf, called the *mid-nerve* or *mid-rib*, and numerous finer ones running parallel on each side. The extremely strong mid-rib that is found in corn, sorghum, etc., gives especial firmness to the leaf. When there are no strongly marked ribs. the leaf is characterized as *flat ;* and its surface may be *smooth*, *rough*, *downy*, or *hairy.* The margin is spoken of as *plane*, *downy*, *hairy*, or *serrate* (saw-edged).

By the position of the leaves on the stem of grasses, a character is afforded by which they may be easily distinguished from the sedges, a closely related family of grass-like plants. Beginning with any leaf on the stem of a true grass, one will find the next leaf exactly on the opposite side of the stem, and the next directly above the starting point. This arrangement of leaves is technically described as *distichous.* In sedges, however, the arrangement is three-ranked, *i. e.*, it is the third leaf from the first, which is directly above the first.

In the day time, the leaves stand out from the stem, with the upper surface turned upwards ; but, at night, they lie quite close to the stem, and, according to Hackel, their surfaces are at an angle of ninety degrees from the position which they occupied during the day. These so-called sleep movements are due to the influence of light and are exhibited by many trees, as well as grasses ; for example, some mimosas.

Other things being equal, the quality and quantity of the leaves of grasses determine their agricultural value.

Inflorescence, or the Arrangement of the Flowering Parts. The small, individual flowers of grasses are called *spikelets*. These together make up what is known as the *inflorescence*; and they are arranged in a dense, compact, or diffuse form.

When the flowers have no pedicels (or stalks) and are closely packed together on the axis, or stem of the plant, they form a *spike*, as in the case of Timothy or Meadow Foxtail (Plate A. Fig 1). If the flowers are arranged on distinct, nearly equal pedicels, at intervals on the stem, the flower cluster is called a *raceme* (a somewhat rare form in grasses); but if they are on compound, branching pedicels, as in Blue Grass, they form what botanists speak of as a *panicle*. (Plate A. Fig. 14.)

If the pedicels are arranged in a circle round the stem, as in Red Top, they form what is called a *whorl*; if they are all on one side of the stem, as in Buffalo grass, Gramma grass, the inflorescence is said to be *one-sided* (Plate A Fig. 7); if the spikelets are arranged cylindrically, as in Timothy, it is described as *cylindrically round*; if they droop, as in Fowl Meadow Grass, *Poa serotina* (Plate 20), it is represented as *nodding*; and if quite close together, as in Orchard grass (Plate A. Fig. 16), it is spoken of as *crowded*.

THE INFLORESCENCE OF GRASSES,

As indicated in the accompanying illustrations (Plate A)

Fig. 1. *Alopecurus pratensis* (meadow foxtail), showing dense spike.
Fig. 2. *Paspalum dilatatum*, showing elongated spike.
Fig. 3. *Hordeum pratense* (wild barley), showing a spike.
Fig. 4. *Agropyrum repens* (couch grass), showing a spike.
Fig. 5. *Elymus condensatus* (giant rye grass), showing a spike.
Fig. 6. *Bouteloua polystachya* (gramma grass), showing a spike.
Fig. 7. *Bouteloua oligiostachya* (gramma grass), showing a spike.
Fig. 8. *Panicum Crus-galli* (barnyard grass), showing a panicle.
Fig. 9. *Agrostis exarata* (variety of red top), showing a panicle.
Fig. 10. *Koeleria cristata* (a prairie grass), showing a panicle.
Fig. 11. *Distichlis maritima* (salt grass), showing a panicle.
Fig. 12. *Bromus secalinus* (chess), showing a panicle.
Fig. 13. *Hierochloa borealis* (Indian hay), showing a panicle.
Fig. 14 *Poa pratensis* (Kentucky blue grass), showing a panicle.
Fig. 16. *Dactylis glomerata* (orchard grass), showing a panicle.

Spikelet. The spikelet consists of three or more scales or bracts, called *glumes*. The first two of these, counting from beneath, are sterile and known as *empty glumes*. Some species, however, have but one of these empty glumes; and, in others, the second is only rudimentarily developed. The next glume above is called the *flowering glume*; and opposite to this, or between it and the axis, is generally placed a smaller and thinner scale, called the *palea* or palet. The mid-rib of either the glume or the palea is often prolonged beyond the end. This prolongation is called an *awn*. It may arise from the base or from any other part of the glumes or palea; and it is *straight*, *smooth*, *twisted*, *bent*, or *bristly*, and of every variety of length.

Opposite or inside of the palea, there are often present on the axis two small delicate scales called *lodicules*. These are much swollen with sap during flowering, and serve to open the flower and expose the stamens and pistil. In species in which they are absent, the reproductive organs extend above the glumes.

The peculiarities of the glumes and palea, as the number of nerves, and the texture of these scaly appendages, etc., furnish the chief means of distinguishing the different genera and species.

Plate A.

Dissection of the Flowers of Grasses,

As indicated in the accompanying illustrations. (Plate B.)

Fig. 1. *Agrostis vulgaris* (red top), showing two spikelets, one closed, one opened.
Fig. 2. *Agrostis exarata* (variety of red top), showing two spikelets, one closed, one opened.
Fig. 3. *Sporobulus Indicus* (carpet grass), showing two spikelets, one closed, one opened.
Fig. 4. *Calamagrostis Canadensis* (blue joint grass), showing an opened spikelet.
Fig. 5. *Phleum pratense* (timothy), showing two spikelets, one closed, one opened.
Fig. 6. *Muhlenbergia diffusa* (Nimble Will), showing two spikelets, one closed, one opened.
Fig. 7. *Paspalum dilalatum*, showing two spikelets, one closed, one opened.
Fig. 8. *Paspalum læve*, showing two spikelets, one closed, one opened.
Fig. 9. *Aristida purpurea* (beard grass), showing spikelet.
Fig. 10. *Setaria setosa*, showing two spikelets, one closed, one opened.
Fig. 11. *Setaria glauca* (yellow foxtail), showing two spikelets, one closed, one opened.
Fig. 12. *Alopecurus pratensis* (meadow foxtail), showing two spikelets, one closed, one opened.
Fig. 13. *Holcus linatus* (velvet grass), showing two spikelets, one closed, one opened.
Fig. 14. *Deschampsia cæspitosa* (hair grass), showing two spikelets, one closed, one opened.
Fig, 15. *Poa serotina* (fowl meadow grass), showing spikelet and one flower.
Fig 16. *Bromus erectus* (brome grass), showing spikelet and one flower.
Fig. 17. *Buchloe dactyloides* (buffalo grass), showing male and female spikelets.

Stamens. The reproductive organs of grasses, as of other plants, are called stamens and pistils. Each stamen consists of two parts; a *filament*, or slender stalk, and (attached to the upper end of the filament) an *anther*, or little sac (usually double), for holding the *pollen*, or fertilizing powder.

In grasses, the filaments are slender and distinct; and on the tip of each is a narrow anther, attached about the middle. The middle of the anther being the point of attachment, it swings to and fro on the filament. The movement of the anther aids materially in scattering the pollen; and, because of this movement, the anther in grasses is described as *versatile*. (See Plate B., figures 1 and 4.)

The pollen of grasses is very fine, spherical, and smooth, is discharged in abundance, and scattered by the wind. Cross-fertilization is the rule; but self-fertilization also takes place, as in the case of wheat.

Pistils. The pistil (or central organ of the flower) usually consists of three parts: the *ovary*, or seed-bearing sac; above this, one or more *styles*, or stalk-like prolongations; and on the top of each style, a *stigma*, or the part which receives the pollen. The style is sometimes very short or wanting altogether.

The pistil of grasses has from one to three styles, each surmounted by a stigma; and the stigmas are usually curved and feathery, giving abundant surface for catching the pollen from the anthers. (Plate B., fig. 12.)

The ovary in grasses is usually round or oval; the fruit is one-seeded; the husk, or pericarp, surrounds the seed; and the palea sometimes adheres to it.

The *embryo*, or young plantlet, lies beneath the skin of the seed, on the front side, at the base.

Fig.1.
Fig.2.
Fig.3.
Fig.4.
Fig.5.
Fig.7
Fig.6.
Fig.8.
Fig.9.
Fig.10.
Fig.11.
Fig.12.
Fig.13.
Fig.16.
Fig.14.
Fig.15.
♂
Fig.17.
♀

PLATE B

VERY BRIEF BOTANICAL DESCRIPTION OF GRASSES, FOLLOWED IN EACH CASE BY NOTES ON THEIR AGRICULTURAL VALUE.

Phleum pratense. Linn.—Timothy, Herd's Grass or Cat's Tail Grass. (Plate 1.)

Roots.—Perennial, fibrous.

Culms.—Tall, erect, and firm.

Leaves.—4 or 5 on stem, rather broad, roughish.

Inflorescence.—Long, cylindrical spike; densely many flowered.

Glumes.—*Empty*, The back fringed with hairs and tipped with a short bristle.

Flowering, Five-ribbed, notched on upper part, covered by outer glumes.

Palea.—Short and pointed, with margins delicately fringed.

Stamens.—Long, with feathery stigmas protruding from apex at flowering time.

Flowers, about beginning of July.

Timothy grows best on soils containing considerable humus, but gives very fair yields on a wide range of soils. For hay, it is one of our most valuable grasses, the product being of excellent quality, heavy, easily cured, and saleable at the highest price. But, for pasture, it is not first-class. The bulbs at the bases of the stems expose it to injury from vermin, insects and close grazing. It also suffers severely from drouth; and, under the most favorable conditions, it affords only a scant aftermath.

Timothy yields a liberal crop of seed, which is easily threshed and cleaned. When sown alone, from 10 to 12 pounds of seed per acre is required.

PLATE 1. TIMOTHY (*Phleum pratense*).

Lolium perenne. Linn.—Ray or Rye grass, Perennial Rye grass, or Darnel. (Plate 2.)

Roots.—Perennial, fibrous, and sometimes producing running shoots.

Culms.—2 to 3 feet high.

Leaves.—Very leafy, flat, narrow, and pointed, dark green in color.

Inflorescence.—Spike like panicle, 6 in. or longer.

Spikelets—8 to 15 flowered, placed edgewise on stem, and arranged alternately on the axis.

Glumes.—*Empty*, outer one nearly as long as spikelet, or longer; inner one, usually lacking.

Flowering, rounded on back and acutely pointed.

Palea.—Short, 2 keeled (2 ridges.)

In general appearance the panicle resembles couch grass.

Lolium Italicum.—Italian Rye grass, a long awn on the flowering glume, leaves broad and succulent, stem longer but more delicate, and lasting only 2 or 3 years, leaves lighter colored.

Lolium temulentum.—Distinguished from L. perenne by length of outer glume and long awns of flowering glume, has a bad reputation, as the seeds contain a narcotic principle, injurious to man and beast.

Of the rye grasses, Perennial grass is the best known. The name, however, is misleading, since, in this country, it cannot be depended upon to give a crop of more than one year, and is therefore entirely unsuitable for meadows or pastures that are required to stand for several years. It is a grass of good quality; and, on rich lands, it yields a fairly heavy crop of hay not much inferior to timothy.

PLATE 2. *Lolium perenne.* (Perennial Rye Grass.)

Dactylis glomerata. Linn.—Orchard grass, Rough Cock's foot. (Plate 3.)

Roots.—Perennial, fibrous.

Culms.—Stout and rough.

Leaves.—Rough, broadly linear, light green color, slightly hairy, flat and keeled. 5 to 6 in number.

Inflorescence.—Dense, branching panicle, lower part more open owing to length of 3-4 flower stalks, upper part more dense.

Spikelets.—Several flowered, crowded in one-sided clusters.

Glumes.—All herbaceous. *Empty*, smaller than flowering.

Flowering, ovate-lanceolate, and rough, with a short awn or point.

Palea.—2 toothed at summit, fringed at base.

Flowers—July 1-14.

Grows in dense tufts, and is very rank growing and hardy.

Orchard Grass is a very hardy perennial. It grows on almost any cultivated soil, but prefers a rich loam, and thrives in shaded locations better than any other cultivated grass. It has a tendency to grow in tufts and to crowd out other grasses, but is nevertheless one of the most valuable varieties for pastures, as it grows early and late in the season, and remains green throughout the longest drouths. It also furnishes a good aftermath, and bears very close grazing. In the management of an Orchard grass pasture, it is a good plan to mow those parts which have not been closely cropped. When this is done, a fine growth of aftermath may be expected.

For hay, Orchard grass is not so highly esteemed as Timothy; and when intended for this purpose, it should be cut in early bloom, or even before blooming.

When sown alone, about 24 pounds of seed per acre should be used.

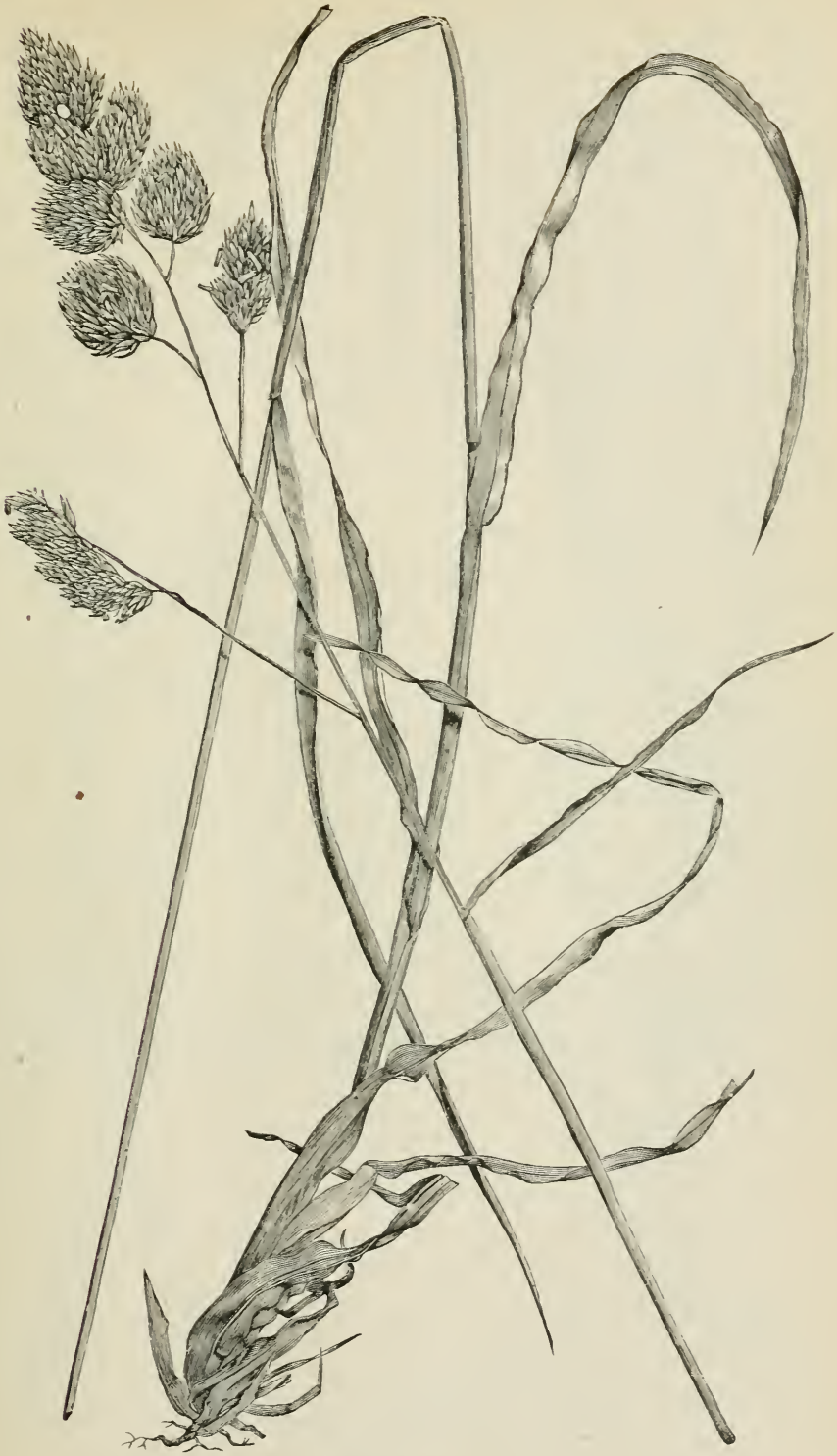


PLATE 3. *Dactylis glomerata*, (Orchard Grass.)

Festuca elatior. Linn.—Taller or Meadow Fescue, English Blue Grass, Evergreen Grass, Randall Grass. (Plate 4.)

Roots.—Perennial, fibrous and deep.

Culms.—Smooth and erect.

Leaves.—Flat, broadish, long and abundant.

Inflorescence.—Narrow, contracted before and after flowering, short branches, somewhat one-sided.

Spikelet.—Crowded, 5 to 10 flowered.

Glumes.—*Empty*, shorter than flowering.

Flowering, 5 nerved, blunt, with rough awn at apex.

Palea.—Acute, green rib along each side, with hairy nerves.

Flowers—About end of June.

Grows in clumps or tufts, very variable.

Variety—*F. pratensis.* 1-3 ft. high, simpler or closer panicle of smaller spikelets, very liable to have ergot.

Tall Fescue and Meadow Fescue are really different varieties, but they are so similar in general characters that they may be treated as one. Meadow Fescue is somewhat earlier than Tall Fescue, and does not yield such a heavy crop. These two grasses are hardy perennials, grow on a great variety of soils, and are consequently suitable for all pasture mixtures. They yield a fairly heavy hay crop of good quality, but their chief use is for pasture.

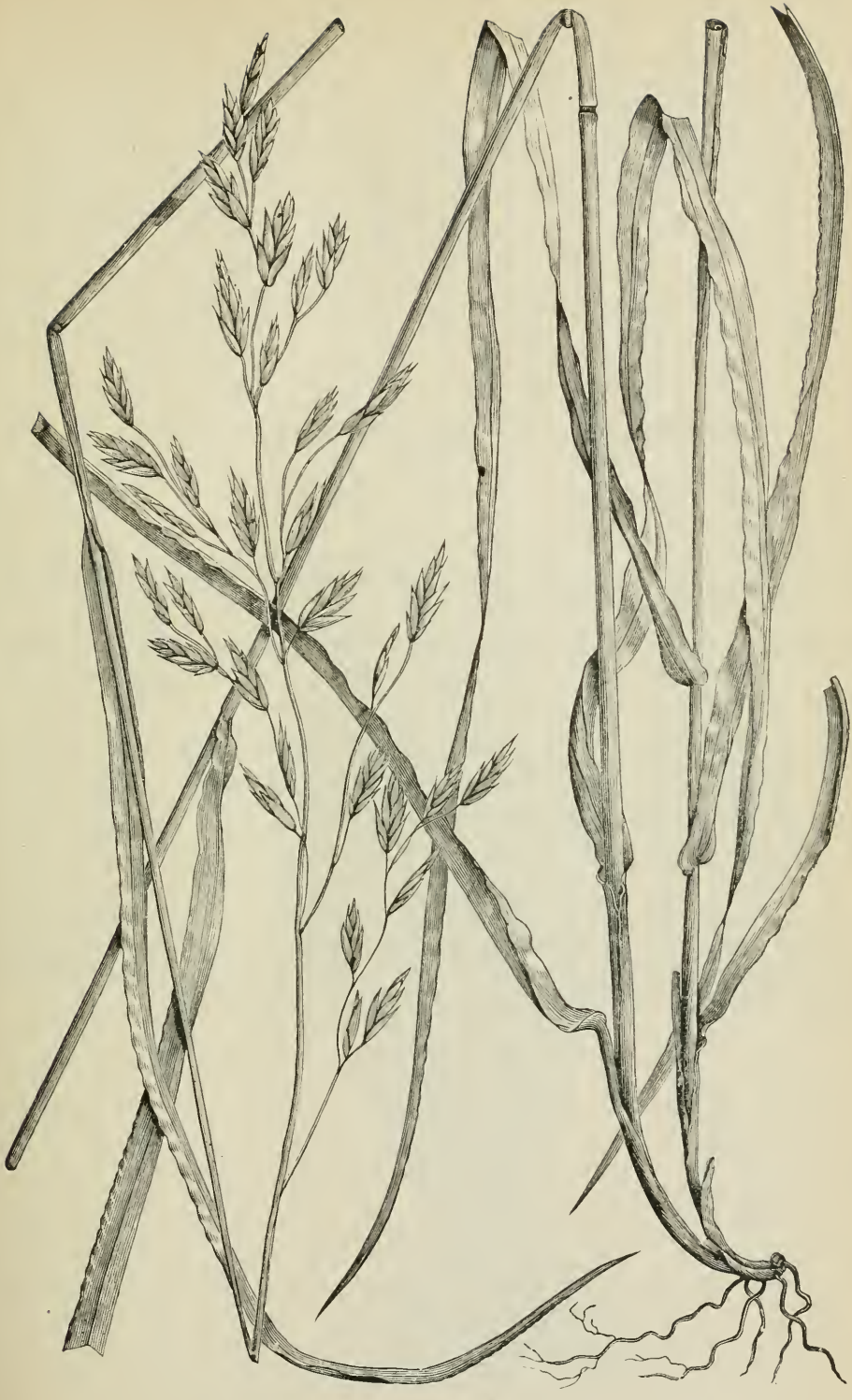


PLATE 4. *Festuca elatior*, (Meadow Fescue.)

Festuca ovina. Linn.—Sheep's Fescue, Pine Bunch Grass.
(Plate 5.)

Roots.—Perennial, deep, fibrous.

Culm.—Smooth and slender, 1-1½ ft. high.

Leaves.—Mostly radical, very narrow and convolute, growing in dense tufts from the roots, awl shaped, and dark in color.

Inflorescence.—One sided, short and more or less compound panicle, open in flowering, 2-4 in. long.

Spikelet.—3-8 flowered.

Glumes.—*Outer*, acute and narrow ; upper, 3 ribbed ; lower, 1 ribbed.

Flowering, lanceolate and roughish with short rough awn.

Palea.—Two teeth at summit, green ribs in margin.

Flowers—June 20-30.

There are many varieties of this grass, which do well even in very sandy soils.

Sheep's Fescue is a small variety with very fine leaves. It has little value unless for rocky pastures. There is another variety, called Hard Fescue, which is rather more valuable than the above, though neither of them is at all suitable for hay.

PLATE 5. *Festuca ovina*, (Sheep's Fescue,)

Arrhenatherum avenaceum. R. & S.—Oat grass, tall oat grass, evergreen grass, meadow oat grass, false oat grass, tall meadow oat grass, grass of the Andes, French rye grass. (Plate 6.)

Root.—Perennial.

Culms.—Erect, rather stout, 2-4 ft. high, of dark green tint.

Leaves.—Broad and flat, about 4 or 5, rough on upper surface, gradually pointed. Ligule conspicuous and hairy on back; short hair on upper surface of blade and on other parts.

Inflorescence.—Elongated, loose, 6-10 in. long, drooping, branches unequal.

Spikelet.—Two flowered with rudimentary third flower, middle flower perfect, lowest flower staminate only, on short stalks.

Glumes.—Glume of lowest flower bearing a long bent awn below middle of back.

Outer, thin and transparent; *flowering*, green, 7-nerved.

Palea.—Linear, thin, and transparent, 2-nerved and 2-toothed.

Flowers—July 7-20.

Grows in loose tufts.

Tall Oat grass is a very hardy perennial. It grows early and late in the season, and will withstand long periods of drouth. Though somewhat bitter, stock eat it well, and it is therefore a suitable grass for permanent pastures, especially on poor lands. For hay, it should be cut as soon as it blossoms. If allowed to stand a very short time after it blooms, it becomes woody and makes very poor hay. It yields a good aftermath, and though not highly esteemed in Great Britain, it is deservedly popular in districts where the rainfall is comparatively slight.

In addition to the above, there is a Yellow Oat grass which is sometimes included in mixtures. It is a light cropper and is not likely to prove valuable in this country.

The seed of Tall Oat grass weighs about 14 pounds to the bushel, in the chaff, and when sown alone, about two bushels per acre is required.

PLATE 6. *Arrhenatherum avenaceum*, (Tall Oat Grass.)

Poa pratensis. Linn.—June grass, Spear grass, Kentucky Blue grass, Blue grass,—English grass, smooth stalked Meadow grass, Green grass. (Plate 7.)

Roots.—Perennial running root-stock.

Culms.—Stems smooth, ligule short and blunt, 1½ to 2 ft. high.

Leaves.—Abundance of long radical leaves, rather narrow and pointed.

Inflorescence.—Short, pyramidal, branches mostly in fives, loose spreading, 2-4 in.

Spikelet.—3-5 flowered, crowded, ovate, mostly on short stalks.

Glumes.—*Empty*, unequal, the first narrow and one nerved, the second broader and three-nerved.

Flowering, hairy on margin and keel, five-nerved tuft of cobwebby hairs at base.

Palea.—Short, *two-toothed.*

Flowers in June

There are a number of varieties of this grass, differing in agricultural importance. The chief merit of the grass lies in the abundance of the soft radical leaves.

It is one of the best known of our native grasses, and is most commonly called June grass. It is also one of the earliest grasses, and furnishes pasture of exceptionally nutritious character during the early part of the season, but does not withstand the summer drouths so well as many other grasses. As it usually finds its way into permanent pastures when the soil is suitable, it is seldom necessary to include it in seed mixtures for this purpose. It is an excellent grass for lawns, its running root-stocks and fine leaves forming a tough, velvety sward. Compared with timothy, its hay value is rather low.

PLATE 7. *Poa pratensis*, (Kentucky Blue grass.)

Poa compressa. Linn.—Wire grass, English Blue grass, Smaller Blue grass Creeping Poa, Canadian Blue grass. (Plate 8.)

Roots.—Running root-stock, perennial.

Culms.—Hard and much flattened, 1-18 in. long, frequently bent at lower joints and then ascending.

Leaves.—Short, scanty, smooth. Bluish green in color, ligule small.

Inflorescence.—Dense and narrow, somewhat one-sided, 1-3 in. long, simple and contracted.

Spikelet.—Sessile, small, 4-6 flowered.

Glumes.—*Outer*, unequal, 3-ribbed.

Flowering, 5-ribbed.

Palea.—Two-nerved, nerves rough, with short hairs.

Flowers—July 1-10.

Low habit of growth, flattened or compressed stems, contracted panicle, less creeping roots, furnish characters by which it is easy to distinguish it from Kentucky Blue grass.

Poa compressa is of little value for hay, owing to its small growth. What pasturage it affords is nutritious, and it will grow on very poor soil, such as sand, gravel, or hard clay.

PLATE 8. *Poa compressa* (Canadian Blue Grass.)

Agrostis vulgaris. With.—Red Top, Bent grass, Fine Bent, Fine Top. (Plate 9.)

Roots.—Perennial, creeping, interlacing and forming a dense sod.

Culms.—Tufted, and slender. Ligule short.

Leaves.—4 or 5, flat, narrow, and roughish.

Inflorescence.—Spreading after flowering, panicle with whorled branches.

Spikelet.—1-flowered.

Glumes.—*Empty*, equal, and longer than the flowering glume.

Flowering, very thin, awned on back, 3-5 nerved.

Palea.—Thin, minute, or none.

Flowers—July 1-10.

Red Top is a fairly hardy perennial, and is best adapted to rather low lands. It is most suitable for pasture mixtures or for lawns, though for the latter purpose probably *Agrostis canina* (Rhode Island Bent Grass) would be more suitable. It is not of much value for hay.

PLATE 9. *Agrostis vulgaris* (Red Top.)

Alopecurus pratensis. Linn.—Meadow Foxtail, English Foxtail. (Plate 10.)

Roots.—Perennial, fibrous, and creeping.

Culms.—Upright, smooth, 2 in. high.

Leaves.—Upper leaf much shorter than its inflated sheath, 4 or 5 at even distance, rather broad and flat.

Inflorescence.—Stout, 1·2½ in. long, cylindrical spike. Awn conspicuously projecting.

Glumes.—*Lower*, acute, awnless, and hairy ;

Flowering, obtuse, awn rising from near the base, half its length twisted.

Palea.—None.

Flowers—June 7-20.

Resembles Timothy, but culm and leaves are shorter ; spikes shorter, broader, and softer ; plant less firm and rough.

Meadow Foxtail is a very early, hardy grass of good quality, used in mixtures for permanent pastures. It requires a rich soil in order to give satisfactory results, and takes several years to become established. It makes hay of good quality, but yields too light a crop and takes too long to become established, to be a profitable grass for this purpose.

PLATE 10. *Alopecurus pratensis* (Meadow Foxtail.)

Setaria Italica Kunth.—Italian Millet, Golden Millet, Leaf Tail Millet, Bengal Grass, Hungarian Grass. (Plate 11).

Roots.—Annual.

Culms.—Erect, 2-3 ft. high.

Leaves.—Long, broad, and flat.

Inflorescenece.—Spike-like panicle, nodding, yellowish or purple.

Glumes.—*Empty*, 3, the lower one small, the second smaller than the third;

Flowering, hardened.

Palea.—Thin.

Stamens.—Sometimes 4 in number.

The terms "Hungarian Grass" and "Millet" are so variably applied that they lead to hopeless confusion. There are a great many varieties in this family, and among the more valuable for cultivation may be mentioned Salzer's Dakota, Golden, Golden Wonder, and Pearl.

Millet requires a rich, warm soil. It forms a valuable "catch crop," that is, it may be sown late in the season to replace a crop that has failed. It should not be sown until the weather becomes warm, usually during June, though it may be sown much later. In preparing the soil, fine tilth is necessary. The quanity of seed used varies considerably, but about 40 pounds per acre will be found satisfactory in most cases. When cut in early bloom, millet makes a fair substitute for hay. If allowed to stand until the seeds have formed, it draws much more heavily upon the soil, and the seeds are generally believed to have an injurious effect upon the kidneys of the animals to which they are fed.

PLATE 11. *Setaria Italica.*

Anthoxanthum odoratum. Linn.—Sweet Vernal Grass, Sweet Scented Vernal Grass, Vernal Grass. (Plate 12.)

Roots.—Perennial, fibrous.

Culms.—Slender, 1 to 1½ ft. high.

Leaves.—Hairy, flat and pointed, scant foliage.

Inflorescence.—Spike-liked, but having many very short, dense branches 2-3 in. long narrow and close.

Spikelets.—3 flowered, only the terminal one perfect, brown or tinged with green.

Glumes.—*Empty* glumes in two pairs, hairy, two-lobed and awned on back.

Flowering, small, smooth, and awnless.

Palea.—Short, three-nerved.

Flowers about end of June.

A low, sweet smelling perennial, the scent arising from a product called cumarin In Europe the scent is extracted and manufactured into perfume.

Odor appears when dry. It is used in grass *mixtures* in Great Britain, but does not appear to thrive in our climate.

PLATE 12. *Anthoxanthum odoratum* (Sweet Vernal.)

Elymus Virginicus. Linn.—Wild Rye grass, Lyme grass, Terrell grass. (Plate 13.)

Roots.—Fibrous, perennial.

Culm.—Stout, 2-3 ft. high.

Leaves.—Leafy, 10-15 in. long, bread and rough.

Inflorescence.—Erect and rigid, 4-5 in. long.

Spikelet.—2-3 at each joint, all alike, and fertile.

Glumes.—*Empty*, lanceolate, very thick and course, strongly nerved, and bristle pointed ;
Flowering, shorter than above, thick, rounded on back, and having stiff awn.

Palea.—Shorter than its glume, 2-keeled, oblong, and blunt.

Flowers—July 10-20.

Abounds in marshes and along streams.

By the time it blooms the lower leaves are dead.

This grass is not suitable for seed mixtures on cultivated lands, but furnishes some food for stock in marshy places.

PLATE 13. *Elymus Virginicus* (Wild Rye.)

Deuxia Canadensis.—Beauv. (*Calamagrostis Canadensis*). Blue Joint, Small reed-grass, Sand grass. (Plate 14.)

Roots.—Perennial, creeping root stocks, spreads from underground stems.

Culm.—Stout, tall, erect, and smooth, up to 4 ft. high.

Leaves.—Flat when fresh, slightly hairy, 1 ft. long, long ligule, very leafy.

Inflorescence.—Open panicle, spreading, especially when flowering, purple tinged, 4-8 in. long.

Spikelet.—1-flowered, with a short hairy pedicel, supposed to be a rudimentary flower.

Glumes.—*Empty*, lanceolate and acute;

Flowering, delicately awned, having silky white tuft of hairs at base.

Palea.—Slim, smaller than its glume, and transparent.

Flowers—July 1-14.

Canadian Blue Joint is a valuable grass for low lands that cannot be drained, and grows on land that is too wet for red top. It is commonly found in "beaver meadows" and marshes, but may also be grown on cultivated land. It remains green after the seeds are ripe, and is relished by stock in all stages of its growth, affording a large amount of nutritious pasturage, and a fairly heavy crop of palatable hay.

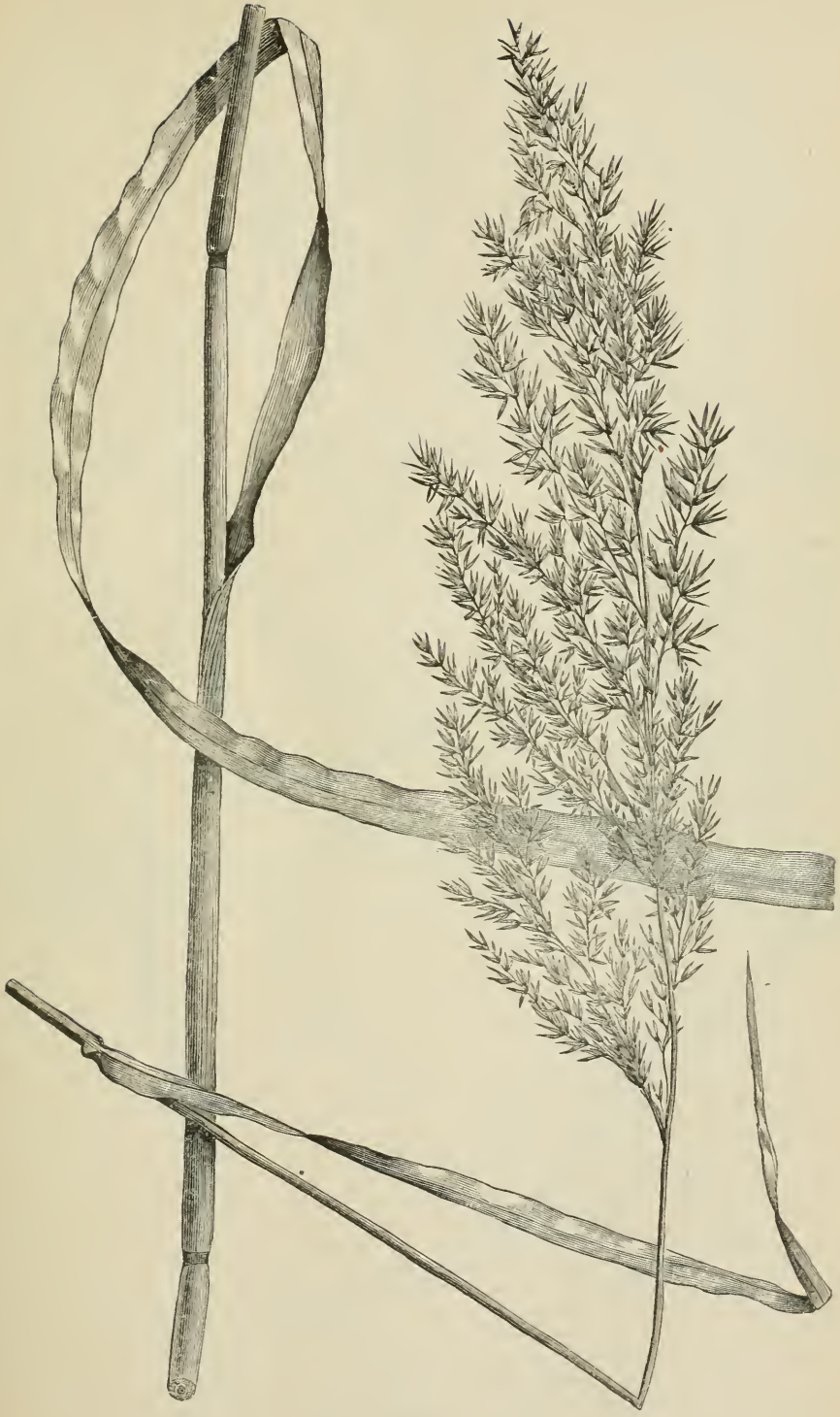


PLATE 14. *Calamagrostis Canadensis* (Blue Joint.)

Muhlenbergia Mexicana. Trin.—Drop Seed Grass, Wood Grass, Knot Root Grass. (Plate 15.)

Roots.—Scaly, creeping, perennial.

Culms.—Upright, much branched, 2-3 ft. high.

Leaves.—Numerous, flat.

Inflorescence.—Contracted, densly flowered panicle.

Glumes.—*Lower*, awnless, sharp pointed, unequal.

Flowering, three nerved, acute, hairy at base.

Palea.—Very acute, smaller than its glume.

Flowers—about end of July.

This species is very serviceable in binding sand, with its strong creeping rhizomes. On rich land, it yields from two to three tons per acre of very fair hay, and affords considerable pasturage.

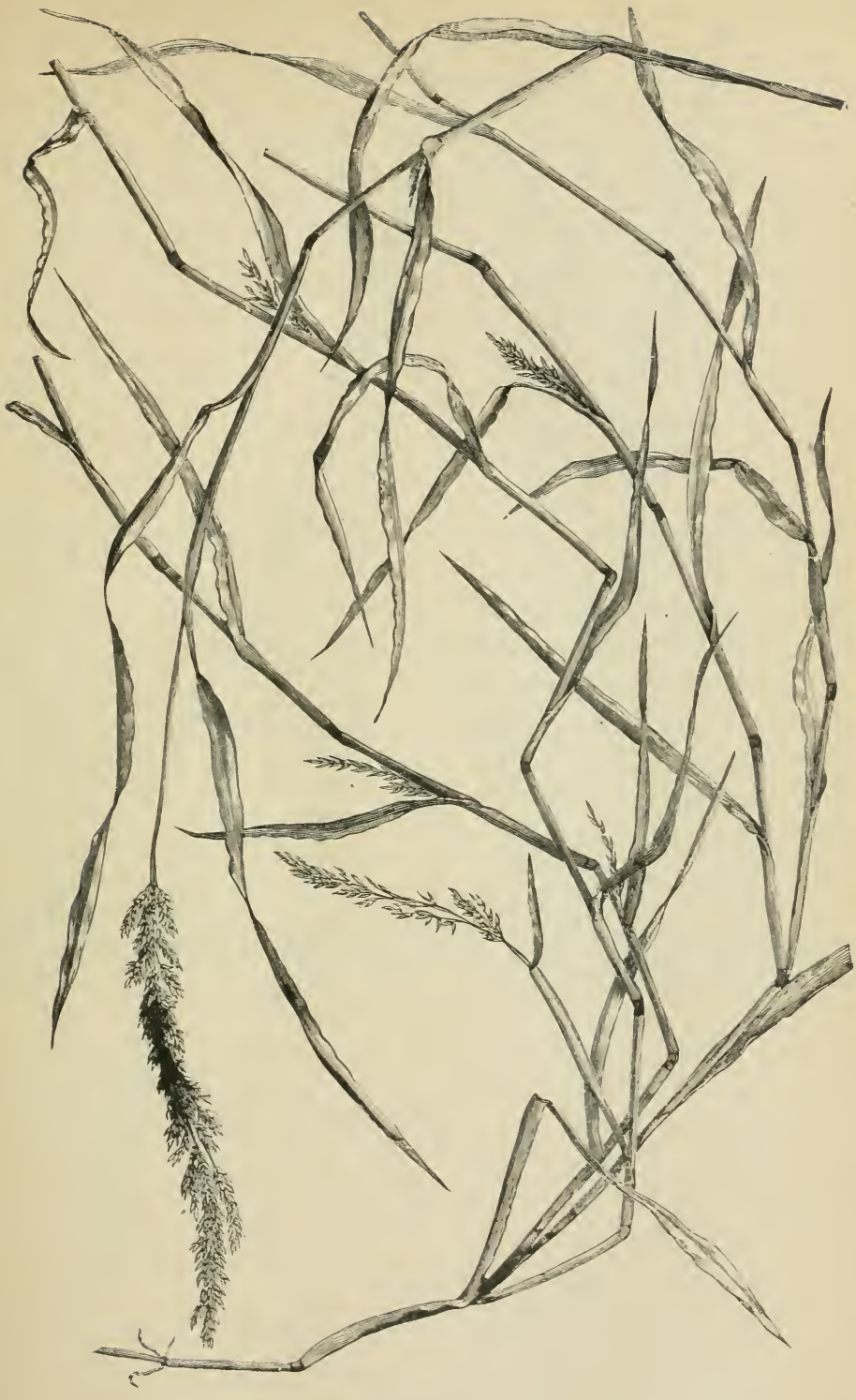


PLATE 15. *Muhlenbergia Mexicana* (Drop Seed Grass)

Muhlenbergia glomerata. Trin.—Spiked Muhlenbergia, Muhlenberg's Grass, Satin Grass, Wild Timothy. (Plate 16.)

Roots.—Hard and knotty with numerous firm scales.

Culms.—Upright, stiffly erect, hard, somewhat compressed, sparingly branched, 1-3 ft. high

Leaves.—Blades linear, 2-4 in. long, rough.

Inflorescence.—2-3 in. long, narrow, contracted, clustered spike, becoming looser below.

Glumes.—*Empty*, awned, nearly equal.

Flowering, twice length of the empty.

Palea.—Two-nerved, acute, and short pointed.

Flowers—about end of July.

This grass is frequently called "Wild Timothy" from the facts that the heads slightly resemble those of Timothy. It is noted for its late period of flowering. On low lands it yields considerable pasturage and hay of no mean quality.

PLATE 16. *Muhlenbergia glomerata* (Wild Timothy.)

Muhlenbergia sylvatica. Torr. and Gray.—Bearded Satin Grass. (Plate 17.)

Roots.—Perennial, fibrous, scaly root-stock.

Culms.—Ascending, much branched, and spreading, 2-4 ft. high.

Leaves.—Leafy, flat, rather broad, and sharp pointed.

Inflorescence.—Dense, many flowered panicle, purplish color.

Glumes.—*Empty*, almost equal, bristle pointed, nearly as long as flowering.

Flowering, awn twice or thrice length of spikelet.

Palea.—Two-nerved, rough at apex.

Resembles *Muhlenbergia Mexicana*, but panicle is looser and bears a bristly awn On low, rich land it is rather a heavier cropper than M. Mexicana

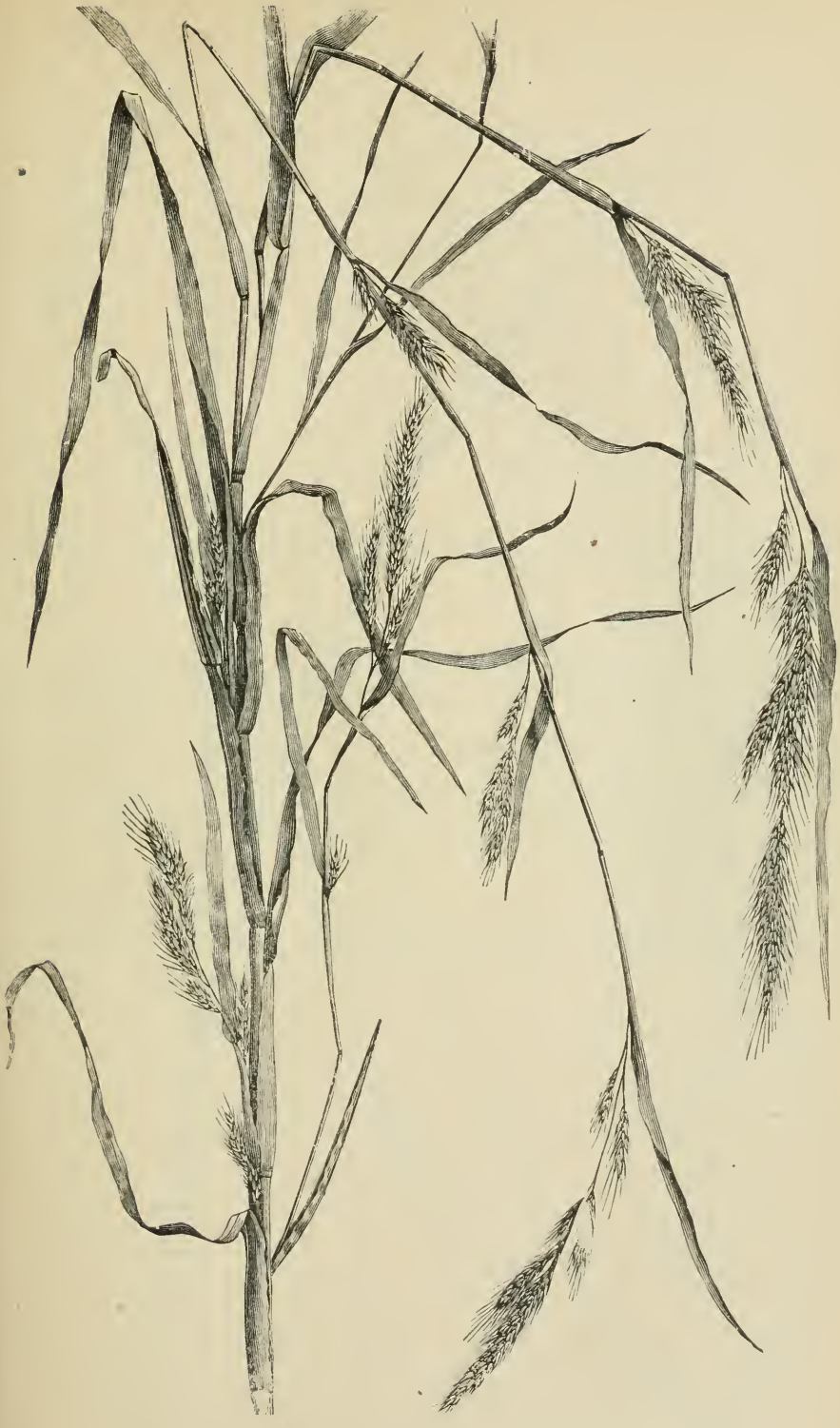


PLATE 17. *Muhlenbergia sylvatica*, (Bearded Satin Grass.)

Glyceria Canadensis. Trin.—Rattlesnake Grass, tall quaking grass. (Plate 18.)

Roots.—Perennial.

Culms.—Stout, 2-3 ft. high, smooth.

Leaves.—Long, lower ones longer and broader than the upper ones.

Inflorescence.—Panicle, 8-9 in. long, large, spreading; branches, slender, long, and branching, mostly in threes.

Spikelets.—Oblong, 6-8 flowered, flattened.

Glumes.—*Empty*, 2, unequal, shorter than the flowering glumes.

Flowering, smooth, blunt apex, 5-9 nerves, prominent and parallel.

Palea.—Shorter than its glume, and two-nerved.

Flowers—in July.

Grows in tufts in wet places and along river banks. Forms good pasturage in wet meadows and makes fair hay. Also is a fine ornamental grass.

Plate 18. *Glyceria Canadensis* (Rattlesnake Grass.)

Phalaris arundinacea. Linn.—Reed canary grass, Ribbon grass. (Plate 19.)

Roots.—Perennial, fibrous, strong, and creeping.

Culms.—Stout, smooth, and leafy, from 2-5 feet high.

Leaves.—6-10 in. long, 1½ in. wide, flat, lanceolate; margins rougher than surface; ligule short and rounded above.

Inflorescence.—Long, dense spike, 3-6 in. long.

Spikelet.—One-flowered and fertile.

Glumes.—*Empty*, 4, the third and fourth being reduced to hairy rudiments; 2nd and 3rd obscured, nerved and hairy on back.

Flowering, one-nerved and awnless.

Palea.—Rounded, one-nerved.

Flowers—about end of June.

The ribbon grass of gardens, the leaves striped with white, is a variety of *Phalaris arundinacea.*

Suitable only for pasture on wet, swampy land. In the early stages of its growth it is eaten readly by stock, but becomes very woody when mature.

Plate 19. *Phalaris arundinacea* (Reed Canary Grass.)

Poa serotina, Ehrh.—False Red Top, Fowl meadow grass, Duck grass, Swamp wire grass. (Plate 20.)

Roots.—Perennial, running root-stock.

Culms.—Tufted, erect, slender, 2-3 feet high.

Leaves.—Narrowly, linear, soft and smooth.

Inflorescene.—Elongated panicle, tinged with dull purple, slender and nodding, branches in fives.

Spikelet.—2-4 flowered, short stalked.

Glumes.—*Outer*, $\frac{1}{8}$ in. long, sharp pointed, rough on keel;

Flowering, very obscurely nerved, cobwebby at base, obtuse or blunt.

Palea.—Acute.

Flowers—July 1-12.

Stems remain green after seed is ripe.

Poa serotina has attracted considerable attention as a grass that will grow on very moist lands, or on lands that are occasionally flooded. Stock eat it readily, and when cut it makes hay of fair quality. It is perhaps worthy of more extended trial in mixtures for low, rich lands.

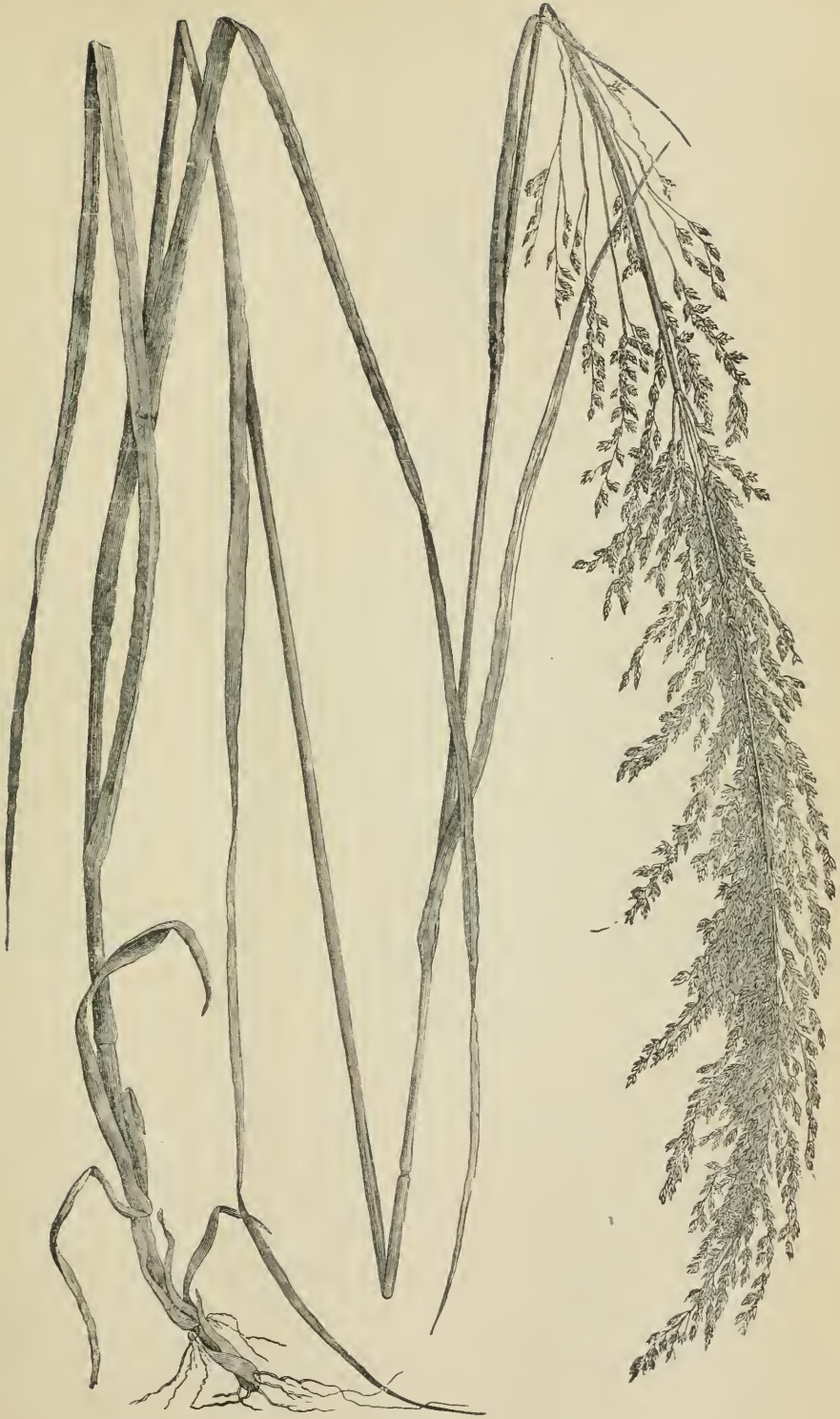


Plate 20. *Poa serotina* (Fowl Meadow Grass.)

Hierochloe borealis. Roem and Schultes.—Vanilla or Seneca grass, Holy grass, Indian Hay. (Plate 21.)

Roots.—Creeping, perennial.

Culms.—Erect, round, smooth, 1-2 ft. high.

Leaves.—Short blades, flat, broad, lanceolate, rough on upper surface; long sheaths.

Inflorescence.—Somewhat one-sided, spreading, pyramidal panicle, 2-5 in long.

Spikelets.—Chestnut colored, ovate, and glossy, three-flowered.

Glumes.—*Outer*, equal, broad, acute, smooth.

Flowering, 5-ribbed, hairy.

Palea.—Two-nerved.

Stamens.—3 in the barren and 2 in fertile florets.

Flowers—May 15-30.

The plants when dry have a vanilla like odor, whence the first name; sometimes strewn before church doors on holy days, and used by Indians for making mats and baskets. In some places it has become a weed.

PLATE 21. *Hierochloe borealis* (Indian Hay).

Panicum Crus-galli. Linn.—Barnyard grass, Barn grass, Cock's foot, Large Crow-foot grass. (Plate 22.)

Roots.—Annual, fibrous.

Culms.—Thick, stout, branching from base.

Leaves.—Very numerous, rather broad and flat, smooth but rough margined.

Inflorescence.—1-3 in. long, crowded spikelets in dense panicle.

Glumes.—*Outer*, 3, the first, broad and short, 3-nerved; the second and third, smooth, downy, the 2nd, 5-nerved, the 3rd, 2-nerved and awned.

Flowering, thin and transparent, smooth.

Palea.—Small and polished.

Flowers in August.

It grows in low rich land, and in the neighborhood of barns and dwellings. It is of very little agricultural value.

PLATE 22. *Panicum Crus-galli.* (Barnyard Grass.)

Agropyrum repens. Beauv.—Couch, Quitch, Quick, Quack, Quake, Scutch, Twitch Dutch, Dog, Wheat, Durfa, Devil's Grass. (Plate 23.)

Roots.—Perennial, creeping extensively, penetrating deeply into the ground, jointed root-stock.

Culms.—1-3 ft. high.

Leaves.—Flat, roughish above; upper ones broader than those springing from root.

Inflorescence.—Close, narrow spike.

Spikelet.—4-8 flowered, slightly notched stem, smooth.

Glumes—*Empty*, equal and opposite, 1-3 nerved.

Flowering, similar, pointed or awned, and with rounded back.

Palea.—Nearly as long as its glume, two marginal, green nerves.

Flowers—July 5-20.

Whatever value Couch Grass may have for pasture, its habit of taking and keeping possession of the soil renders it extremely objectionable. It flourishes best in loamy or humus soils, from which it is especially difficult to eradicate.

To destroy this grass, the cultivation should be such as to prevent its appearing above the surface. Hoed crops of various kinds, or a bare fallow, on which buckwheat may be sown and plowed under, will be found useful. A well manured and carefully cultivated rape crop is especially effective as a means of destroying this grass.

PLATE 23. *Agropyrum repens* (Couch Grass.)

Bromus secalinus. Linn.—Chess, Cheat. (Plate 24.)

Roots.—Annual, fibrous.

Culms.—Simple, round, erect, and smooth, about 3 ft. high.

Leaves.—Broadish, flat, pointed, ribbed, rough on edges and under surface, downy above.

Inflorescence.—Spreading, drooping, little branched, diffuse panicle.

Spikelets.—Oblong-ovate, 7-10 flowered.

Glumes—Empty, unequal, acute, and awnless;

Flowering, shorter than palet, short awn or awnless.

Palea.—Two keeled, grain adhering to palea, strongly nerved, the nerves fringed with bristles.

Flowers—July 1-10.

"The idea that chess is degenerated wheat is erroneous and entirely without foundation. Chess seed will produce chess and only chess."

Chess is most commonly found among wheat and rye. The flour obtained from it is dark colored and narcotic. Care in the selection of seed grain and careful cultivation tending to prevent the maturing of these seeds are the chief remedies.

To the same order belong the brome grasses of which there are many varieties Perhaps the best is *Bromus inermis* (Awnless Brome Grass), which is highly spoken of in some parts of the United States, but which is not sufficiently well known in Ontario to be pronounced upon.

Plate 24. *Bromus secalinus* (Chess.)

Avena fatua. L.—Wild Oat. (Plate 25.)

Roots.—Annual, fibrous, thickened at base.

Culms.—Erect, simple, smooth.

Leaves.—Leafy, linear, flat and rough.

Inflorescence.—Loose panicle, nodding, branched, and spreading.

Spikelets.—Pendulous and long.

Glumes.—*Empty*, large, long, and unequal;

Flowering, rounded on back, 5-11 nerved, bearing a bent awn and covered with long brown hairs.

Palea.—Shorter than its glume, ribbed, green along the margin, fringed at edge.

Flowers—in July.

Wild Oats are at home in any soil that will grow cereals, and they ripen their seeds among almost any cereal crop. The seeds possess wonderful vitality, some of them remaining buried in the soil for years and germinating as soon as they are brought under favorable conditions.

From what has been said, it follows that on a field infested with wild oats, cereal crops should be dropped out of the rotation as far as possible; and hoed crops, soiling crops, hay and pasture should take their place. To get the land under grass, it should be fallowed during part of the season, the cultivation being frequent and shallow, to destroy all seeds that may have germinated in the upper layer of soil. The land can then be sown with winter wheat and seeded, or with an early variety of barley, which should be cut on the green side. The treatment mentioned, is suitable for pasture land, or land which has produced a hay or soiling crop during the fore part of the season.

Plate 25. *Avena fatua* (Wild Oat.)

Setaria glauca. Beauv.—Foxtail, Yellow foxtail, Bottle grass, Puss grass, Pigeon grass. (Plate 26.)

Roots.—Perennial.

Culms.—Erect, about 2 ft. high, rough; sheath smooth, ligule, a fringe of hairs.

Leaves.—Flat, quite rough above, and smoother on under surface.

Inflorescence.—Dense, close spike, cylindrical, bristly, and tawny yellow in color.

Spikelets,—Ovoid, below the joint are solitary or clustered bristles, resembling awns, 6-12 in cluster.

Glumes.—*Empty*, 3, lower one small and the second shorter than the third;

Flowering, transversely wrinkled.

Palea.—Thin.

Flowers in August.

It has very little agricultural value. It is a common weed in stubble, fallow, or root fields.

Plate 26. *Setaria glauca.* (Yellow Foxtail.)

Composition of Grasses described in this Bulletin—Compiled from Dominion and United States analyses.

Species.		Stage of growth.	Fresh or Green material.						Water, free substance.				
Technical.	Common.		Water.	Ash.	Albuminoids.	Fibre.	Carbohydrates.	Fat.	Ash.	Albuminoids.	Fibre.	Carbohydrates.	Fat.
1 Phleum pratense	Timothy	Speared	71.35	2.05	3.30	7.22	15.03	1.14	7.37	12 63	25.98	50.03	3.98
2 "	"	Seed formed	64.59	1.56	2.80	10.80	19.22	1.00	4.38	7.96	30.48	54.31	2.86
3 Lolium perenne	Perennial Rye	In flower	79.40	1.59	2.12	6.22	10.17	.50	7.72	10.50	30.83	48.44	2.51
4 Dactylis glomerata	Orchard grass	Hay	14.30	6.87	7.49	22.33	46.96	2.05	8 02	8.74	26.05	54.80	2.39
5 Festuca elatior	Meadow Fescue	In flower	74.38	1.72	2.93	9.88	10.55	.54	6.73	11.44	38.61	41.08	2.14
6 Festuca ovina	Sheep's Fescue	Just before flowering	67.00	1.85	3.26	7.85	19.21	.83	5.60	9.90	23.79	58.20	2.51
7 Arrhenatherum avenaceum	Tall oat grass	Before flowering	62.30	2.99	3.31	9.17	20.71	1.52	7.93	8.78	24.33	54.93	4.03
8 Poa pratensis	Kentucky Blue grass	In flower	66.05	2.12	4.63	7.85	18.08	1.25	6.26	13.62	23.13	53.27	3.70
9 Poa compressa	Canadian Blue grass	After flowering	66.42	2.01	3.77	7.55	19.26	.98	6.00	11.41	22.31	57.17	3.10
10 Agrostis vulgaris	Red Top	In flower	61.40	2.81	4.29	8.50	21.93	1.11	7.27	11.02	22.02	56.82	2.87
11 Alopecurus pratensis	Meadow Fox tail	In flower	70.76	2.38	3.29	7.86	14.77	.93	8.39	11.49	28.72	48.27	3.11
12 Setaria Italica	Hungarian Millet	In flower	68.06	1.91	2.91	9.40	17.24	.48	6.60	9.13	29.44	53.93	1.51
13 Anthoxanthum odoratum	Vernal grass	In flower	78.80	1.50	2.01	4.37	12.61	.71	7.09	9.47	20.63	59.45	3.36
14 Muhlenbergia Mexicana	Drop Seed	Seed formed	49.78	2.39	4.64	14.92	27.59	.68	4.77	9.25	29.72	54.91	1.35
15 Elymus Virginicus	Wild Rye	In flower	68.38	1.26	2.62	11.34	16.01	.39	4.04	8.29	39.04	47.38	1.25
16 Calamagrostis Canadensis	Canadian Blue Joint	Seed formed	56.69	2.02	4.57	16.06	19.28	1.38	4.68	10.56	36.09	45.49	3.18
17 Glyceria Canadensis	Rattlesnake Grass	Hay	14.30	6.26	6.97	21.94	48.64	1.89	7.30	8.13	25.60	56.77	2.20
18 Muhlenbergia Glomerata	Wild Timothy	In flower	62.72	2.86	5.40	11.19	17.37	.46	7.67	14.50	30.03	46.56	1.24
19 Phalaris arundinacea	Reed Canary grass		67.55	2.22	5.39	7.35	16.62	.87	6.84	16.62	22.67	51.19	2.68
20 Poa serotina	Fowl meadow grass	In flower	67.57	2.18	3.93	11.83	13.54	.95	6.74	12.12	36.48	41.73	2.93
21 Hierochloe borealis	Indian Hay	In seed	75.32	1.64	4.93	6.14	10.68	1.29	6.63	20.00	43.25	24.88	5.24
22 Panicum Crus-galli	Barnyard grass	Hay	14.30	5.98	6.66	24.78	46.44	1.84	6.98	7.17	28.91	54.19	2.15
23 Agropyrum repens	Couch grass	In flower	72.88	2.02	4.54	8.15	11.57	.84	7.45	16.75	30.03	42.66	3.11
24 Bromus secalinus	Chess	Ripe	14.30	6.10	6.61	20.39	49.11	3.49	7.12	7.71	23.79	57.30	4.08
25 Avena fatua	Wild oat	Ripe	14.30	4.25	7.50	22.42	48.10	3.43	4.96	8.75	26.16	56.13	4.00
26 Setaria glauca	Yellow Fox tail	Seed	68.40	2.30	2.86	8.13	17.47	.84	7.94	8.52	21.94	58.54	3.06

General Observations in Conclusion.

In ordering grass seeds, it is always best to give the scientific as well as the common name of the varieties ordered. This is advisable in order to prevent mistakes, for frequently the common name is applied to different varieties by different people.

Grass and clover seeds form a common medium for the distribution of weed seeds, and it therefore becomes necessary for the buyer to exercise great care in his selection. Only responsible dealers should be patronized.

In the preparation of the soil for grass seeds, fertility, cleanliness, and fineness of tilth are of prime importance. It is the height of folly to sow grass seed on poor, dirty, badly cultivated soil. The cleaning crop should precede the grass, and it is just as unreasonable to expect a good crop of hay from poor soil as it is to expect a heavy crop of grain under like conditions. Also, the finer the state of tilth to which the land is worked, the larger is the percentage of grass seeds which will germinate, and the better able are the young plants to withstand the summer drouths.

Care should also be taken not to cover grass seed deeply. In light soils they admit of being covered more deeply than in clay, but in any soil light covering is in order. If a harrow is used after the seed is sown it should be a very light one ; but rolling is usually sufficient.

The question of grass mixture is a very complicated one, and it is impossible to state which would be the most suitable mixture for all conditions. It is highly probable that the old standard mixture of timothy and clover will continue to be used in many districts for years to come. As noted before, however, timothy has many deficiencies as a pasture grass, and does not compare with orchard grass, fescue, or tall oat grass, for this purpose. Its great powers of remaining green during droughts, and the strong vitality of its seeds, render orchard grass particularly valuable for pasture.

Though no attempt is made to dictate regarding seed mixtures, it is perhaps not out of place to give a few examples. A mixture that has been used on the College Farm is as follows :

Red clover	6 lb.
Alsike	3 "
Timothy	4 "
Perennial Rye Grass	2 "
Total	15 lb. per acre.

This mixture is for meadows that are to be broken up at the end of the second year. The alsike clover not only gives variety, but, if there are any low places in the field, it thrives much better on the low land than the red clover. The value of perennial rye grass in the mixture is doubtful, and on many soils it may profitably be discarded ; or, perhaps better still (if the land is to be pastured during part of the time), its place may be taken by orchard grass.

For permanent pastures, or lands that are to be pastured for several years, the following mixture was suggested by Mr. Zavitz, our Experimentalist, in the College Report for 1893 :

Orchard grass	4 lb.
Meadow Fescue	4 "
Tall Oat grass	3 "
Timothy	2 "
Meadow Foxtail	2 "
Alfalfa	5 "
Alsike clover	2 "
White clover	1 "
Yellow clover	1 "
Total seed per acre	24 lb.

The foregoing mixture was not given by Mr. Zavitz as conclusive, nor is it offered here as such. On low, rather wet lands, or on land with a stiff clay subsoil, it would be little use to sow Alfalfa, and grasses could be selected to take its place. Thus a great many changes could be made in the mixture to suit the conditions under which it was to be sown, without materially altering its value.

For lawns, the following will be found a very satisfactory mixture :

Kentucky Blue Grass	5 lb.
Red Top	5 "
White clover	5 "
Total	15 lb. per acre.

Rhode Island Bent *(Agrostis canina)* might be substituted for red top, or a less quantity of white clover might be used, according to the taste of the user.

As a rule, it is unsatisfactory to purchase any prepared seed mixtures. It is far better to deal with some reliable seedman, order seeds by their scientific as well as their common names, and prepare a mixture to suit oneself. By following this plan a person knows what he is getting ; but ready made mixtures frequently contain an abundance of trash, utterly worthless for the purpose intended.

Liquid Paris Green.

We also made some experiments with what is known as "Liquid Paris Green," sold exclusively by the Liquid Paris Green Co., of Toronto. This material appears to be the waste product obtained when making Paris green, and contains a considerable quantity of free acid.

We tested the mixture on tomato plants in one of the College greenhouses. The plants were from twelve to eighteen inches high, and were in vigorous growth. In applying the mixture, care was taken to have it evenly distributed. An atomizer was used in most cases ; and the results were as follows :

One part of	liquid	Paris	green	to	15	parts of	water :	Plant was completely destroyed in eight hours
"	"	"	"		20	"	"	" " " "
"	"	"	"		25	"	"	" " " "
"	"	"	"		30	"	"	" " " "
"	"	"	"		40	"	"	" " " "
"	"	"	"		50	"	Plant destroyed.	
"	"	"	"		60	"	"	
"	"	"	"		75	"	"	
"	"	"	"		80	"	Plant badly burnt.	
"	"	"	"		90	"	Only the younger leaves burnt.	
"	"	"	"		100	"	Tips of young leaves burnt.	

No higher strengths of the liquid Paris green were tried, as these results, together with the chemical tests, fully established the fact that there was a large quantity of acid present. In order to neutralize this, lime was added, till the mixture turned red litmus blue. This was sprayed on tomato plants, diluted thus :

One part of	liquid	Paris	green and	lime to	25	parts	water : Plant burnt.
"	"	"	"		50	"	Plant all right.
"	"	"	"		80	"	" "

The strongest mixture of the neutralized liquid, one to twenty-five was also applied to the foliage of gooseberry bushes, plum trees, and apple trees, with no harmful results. These outside tests upon fruit trees were, however, hardly satisfactory, as the frost of the nights 14th, 15th, and 16th May, injured the foliage to such an extent, that it was hard to tell whether the frost had done the injury or the liquid Paris green. Even some time after

the 16th May it was very hard to conduct reliable experiments in this locality, on account of the devastation of foliage by the frost. The following strengths were used on apple trees :

One part	liquid Paris green to	40 water	All burnt the foliage badly
"	"	50	
"	"	60	
"	"	75	

causing dark blotches on the leaves, where the mixture had collected in drops. In many places, the tissue of the leaf was completely eaten away, nothing but the nerves and mid rib remaining. The older leaves naturally showed more power of resistance than the younger ones.

The effect of the mixture upon the Forest tent caterpillar, (*Clisiocampa Sylvatica*) was also tried.

Liquid Paris green, one part to 100 parts of water, killed the caterpillar in two or three days. After eating a hearty meal, these caterpillars appeared quite sick, either keeping very still, or spinning a little web and remaining within till dead. The body shortened and swelled somewhat, and at the end of the third day all were dead.

Stronger mixtures, one to twenty-five and one to fifty, were also used, with like results. Control caterpillars, kept under the same conditions as those experimented upon but having unsprayed food, remained healthy and made good growth.

The Company on learning the results of our tests, proceeded to neutralize the liquid Paris green with soda ash, which gave the mixture a bright green appearance. This was applied, one part to fifty of water, also a strength of one to sixty, on potatoes. The plants were badly scorched and ultimately died. The same strength killed respectively ten per cent. and eight per cent. of the potato beetle. When neutralized with lime, however, it produced no harmful results on potato foliage.

No further experiments were carried on, as I left to attend the hygienic laboratory of the University of Michigan for part of the summer months. On my return, I had to see about the equipment, etc., of the Bacteriological Department. As the new laboratory was not finished till the beginning of December, I had not much time for further original work.

Fungous Diseases.

A circular letter was sent out to the florists of the Province, making inquiry as to whether they were troubled with fungous diseases in their greenhouses, and asking for specimens of affected foliage. A few sent answers to our questions ; and experiments are now being conducted in our own greenhouses, to find a satisfactory remedy for these fungous pests.

Rose Mildew.

By the use of these two mixtures, the Carnation Rust and Rose Mildew have been kept well in check in our own houses. Also plants sent us by florists, which were literally covered with rust, have been much benefited by the treatment; and no sign of rust is manifest on the new growth. Of these two, the first seems to be the better for the Rust, although good results have ensued from the use of the potassium sulphide. The last, however, is to be preferred for roses, as it does not injure the bloom, even if the nozzle is held for a minute close to the flower.

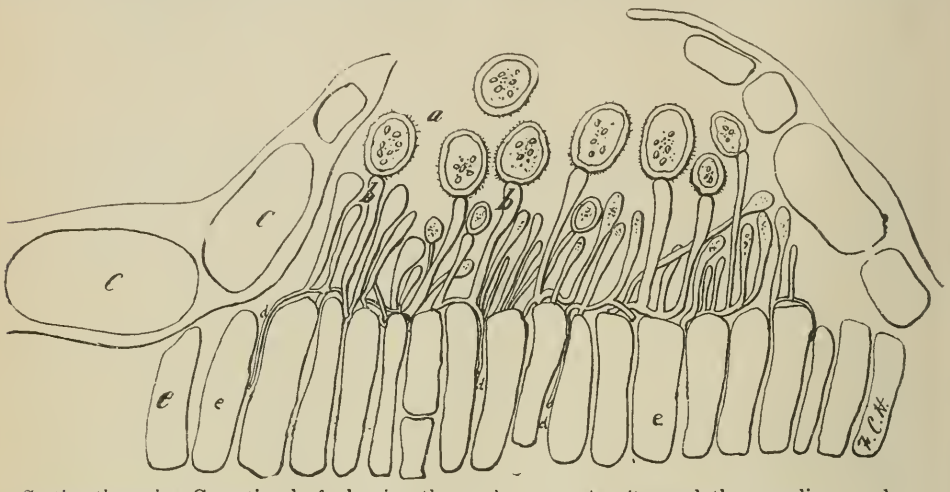
By following out these simple methods much valuable bloom can be saved.

That the damage from such fungi is considerable, may be gathered from the fact that one grower estimated his loss from Rose Mildew to be between $400 and $700 ; another stated that his loss from the Carnation Rust last year was not less than $250.

Further experiments are being carried on ; and, as results are obtained, information will be given to the public.

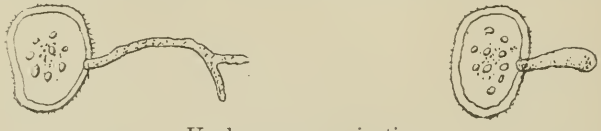
Carnation Rust.

The Carnation rust, (*Uromyces caryophyllinus*, Schrank) seems to be the most prevalent and injurious in the greenhouses throughout the Province. This appears as rusty blotches, which burst the skin, or epidermis, of the plant and scatter their spores in all directions. These, as soon as they touch other portions of the plant, immediately germinate and force their long tubular filaments, (*hyphar*) through the stomata, or minute openings of the leaves, penetrate the tissues, and thus sap the vitality of the plant. A camera lucida drawing, from a section of a leaf, is here given, which will explain the manner of growth of this parasite. Although, perhaps, a little early to give *positive* information from our own experiments as to the best means of combatting this pest, the following mixtures appears to give good results; but, in order to be successful, the spraying should be done every week, or, at the longest, every ten days. A knapsack sprayer with Vermorel nozzle, is useful for spraying; but, when only a few plants are to be treated, a large atomizer may be used.



Section through a Carnation leaf, showing the uredo spores *in situ*, and the mycelium made up of hyphal threads penetrating the tissues; the growth of the fungus rupturing the epidermis.

a Uredo spores. *b*. Pedicels supporting the spores. *c*. Ruptured skin or epidermis of the plant. *d*. Hyphal threads passing between the *e*. Palisade cells of the leaf.



Uredo spores germinating.

Mixture No. 1. Ammoniacal copper carbonate.—Copper carbonate, one ounce; ammonia, about one pint, or enough to dissolve the copper carbonate; and water, nine gallons.

If glucose is added to this mixture, it will stay on the leaves better, as all solutions used on the carnation, on account of the shape of the foliage, are apt to run and collect in drops at the base or tip of the leaf.

Mixture No. 2. Potassium sulphide, quarter of an ounce; water, one gallon.

This seems to be very effective against the Rose Mildew (*Sphærotheca pannosa*, Wallr.); and, as it does not mark the foliage or the bloom, florists should give it a fair trial. Spraying once a week, and, and in addition, painting the hot-water pipes with a mixture of equal parts of sulphur and lime, will produce satisfactory results.

Class Room and Laboratory Work.

The recent increase of laboratory accommodation and equipment will enable us hereafter to give a much broader and more exact knowledge to our students. Since my course at Cornell University, many of the methods in vogue there have been used with much success and satisfaction here. I speak with special reference to vegetable histology. In order to place plant pathology on an equal footing, it will be necessary to purchase a herbarium of *cryptogamic* plants, to serve as a formation upon which to build a good collection. It takes considerable time, which, unfortunately is not at my disposal, to collect and classify such material. Should this be done, a good knowledge of cryptogamic botany could be imparted. Without such collection, the task of demonstration is almost impossible

The Library.

During the year, a number of valuable books have been added to the library; but it cannot even now be said that it is up to date. The necessity of having it considerably enlarged is more urgent now than formerly, as the change in the Third year course of study has widened the field of investigation and necessitated closer scientific research than heretofore. The amount voted for the library is entirely inadequate to meet these wants, especially as more than half the amount has to be expended on newspapers and periodicals for the reading room. At the Agricultural College in connection with Wisconsin University from $500 to $700 is appropriated annually for the library. At the Pennsylvania State Agricultural College, 720 volumes were added in 1895, and their library at present numbers some 11,000 volumes. Alabama has $600 voted for the purchase of new books, while the Massachusetts Agricultural College contains 17,000 volumes and adds 800 to 1,000 every year, and the librarian is given such powers, that "he never hesitates to purchase new books, and tries to keep each department balanced with the others." From these facts, it will be seen that we are somewhat behind in the matter of library, and it is to be hoped that a larger expenditure will be made in this very important part of our education equipment. We are adopting the card catalogue system.

About 500 volumes have been added to the library this year, a number of them being reports and herd books which were sent free. I wrote to all the Experiment Stations and Boards of Agriculture in the United States, requesting them to have our name placed on their mailing list, and asking them to supply us the back or missing numbers of their bulletins and reports. A great many of them very courteously sent when practicable, those numbers which were missing from our shelves. I wish to thank these stations, and I have also to thank the Rothamstead Station, England, for their valuable report; also Messrs. W. Atlee Burpee & Co., of Philadelphia, for their donation of several agricultural works. The following is a list of books added during the year 1895:

Agriculture	35	Agricultural Reports	130
History	36	Sessional Papers	40
Horticulture	10	Botany	42
Dairying	14	Veterinary Anatomy	4
Zoology	5	Chemistry	12
Bacteriology	24	Physics	9
Poultry	4	Entomology	3
Poetry	13	Herd Books	33
Roads	1	General literature	12
Theology	9	Fiction	12
Essays	10	Geology	2
Biology	6	Bookkeeping	1
Biography	15	Economics	5
Travels	8	Miscellaneous	8

Reading Room.

The following is a list of the papers, journals, and magazines which are received by the College, and are for the use of the students in attendance:

(a) *Sent free by the Publishers.*

Canadian Baptist, Toronto; Christian Guardian, Toronto; Canada Presbyterian, Toronto; Monthly Weather Review, Toronto; Presbyterian Review, Toronto; Sheep Breeder and Wool Grower, Chicago; Canadian Horticulturist, Grimsby; Canadian Entomologist, London, Ont.; Bee Journal, Beeton; Acton Free Press, Acton; Ontario Evangelist, Erin, Ont.; Evangelical Churchman, Toronto; Farmers' Review Chicago; Canadian Independent, Toronto; Rural Home Journal, Kentucky; Canadian Evangelist, Toronto; Canadian Bee Journal, Brantford; Poultry Journal, Beeton; Farmers' Home, Ohio; Farmers Review, Chicago; Swine Breeders' Journal, Indianapolis; American Swine-herd, Chicago.

(b) *Furnished by the College.*

Daily Globe, Toronto; Daily Mail and Empire, Toronto; Daily Mercury, Guelph; Daily Herald, Guelph; Rural Canadian, Toronto; Poultry Review, Toronto; Farmers' Advocate, London, Ont.; Nor'-West Farmer, Winnipeg; Breeders' Gazette, Chicago; American Garden, Greenfield, Mass.; Cultivator and Country Gentleman, Albany, N. Y.; Scientific American, New York; Live Stock Journal, England; American Dairyman, New York; Hoard's Dairyman, Ft. Atkinson, Wis.; Maritime Agriculturist, Sackville, N.B.; Garden and Forest, New York; Farming, Toronto; Review of Reviews, London; Microscopical Journal, Washington.

The library is open five hours each day at the times best suited to the convenience of the students; and, for services therein. I wish to express my indebtedness to Messrs. Doherty and Hodgetts, the former for looking after the issue, etc., of books, and the latter for catalogue work.

In conclusion, I have to thank you and the Minister of Agriculture for the enterprise and liberality with which you have planned and equipped the Bacteriological Laboratory; and I trust that the work done will justify the trouble and expenditure under this head.

Respectfully submitted,

F. C. HARRISON.

Ontario Agricultural College,
Guelph, December 31st, 1895.

PART X.

REPORT OF THE EXPERIMENTALIST.

To the President of the Ontario Agricultural College:

SIR,—I have the honor of submitting for your consideration the report of the experimental department of the Ontario Agricultural College for the year 1895. The work in this department during the past year has been, on the whole, satisfactory. A larger area has been devoted to purely experimental purposes than ever before; the number of field plots has been slightly increased; several new experiments of a practical character have been started; some new varieties of farm crops have been imported; and the number of packages of seeds and fertilizers distributed among the farmers of Ontario has been greater than that of any previous year. The aim in this work, however, is not so much to increase the number of the plots and the variety of the experiments as it is to repeat for several years, in a truly systematic way and with great care and accuracy, the experiments which have been undertaken. After a test has been conducted for a few seasons the reports are greatly increased in value when presented year by year, as they give not only the result of the test in the year reported upon, but also the accumulated results of the same test of the previous seasons. You will notice in the following pages of this report that a large number of our variety tests have been carried on for seven years in succession, and also that a number of tests in methods of cultivation, in methods of planting, in the application of fertilizers, etc., have extended over a period of from four to five years. In fact, we believe that an experiment is not worth starting unless it is worth repeating through a variety of seasons, in order to obtain valuable and reliable information therefrom.

We are pleased to observe that our work in the experimental department is being appreciated more and more as time goes on. This fact is made manifest by the increasing number of letters received from farmers, seedsmen, editors of agricultural papers, etc., throughout the country; by the large number of people who visit our experimental grounds each summer; and by the increasing demand for packages of seeds of leading varieties of farm crops by farmers in nearly all sections of Ontario.

EXPERIMENTAL WORK FOR 1895.

During the past season we had in all 2,005 plots devoted to experiments with various kinds of farm crops. These were divided as follows:

Grain	654 plots.
Roots	376 "
Potatoes	364 "
Fodder crops	450 "
Grasses and clovers	59 "
Miscellaneous crops	32 "
Work in connection with the Experimental Union	70 "

We have just passed through one of the severest seasons for experimental work since my connection with the experimental department, commencing in 1886. During the first two weeks of May there was frost at the College six separate nights, the ther-

mometer reaching as low as ten degrees above zero. The mangel wurzel plants of the different experiments were nearly all from one to two inches high at the time of this frost and were completely destroyed. The mangel seed, therefore, had to be sown the second time. The frost also injured some of the spring grains as well, but not so seriously as to prevent their recovery to a large extent. Besides the drawback from the frost, there was also a large deficiency in the amount of rainfall during the growing season, especially during the months of April and June. Great care had to be exercised in preparing the soil, in order to secure uniformity in the germination of the seed for the various experiments; and in spite of all the care exercised, a few experiments with corn and roots will not be reported upon, because of the lack of a complete germination of the seed. Notwithstanding the unfavorable season, however, we are enabled to present in this report as large a number of successful experiments as in any previous year.

The Experimental Grounds.

The land now used for experimental purposes is in a compact block, about a quarter of a mile in length and slightly more than a quarter of a mile in width. As the grounds are nearly square, and as all roads run at right angles to one another, there has been no difficulty in dividing the land into a large number of plots, uniform in shape and size. Winding roads may be beautiful in appearance, but they are troublesome in grounds devoted to experimental work. Every one of the two thousand plots used during the past year was accessible by a waggon and team. There are upwards of five miles of driveways through the grounds, varying in width from eight to twenty-three feet. These driveways are required to handle properly the crops on the various plots at the right time, and also to allow the large companies of farmers who visit the grounds from summer to summer to pass between the different ranges of plots, read the names on the labels and examine the growth and character of the various crops under experiment. Not only are the ranges of plots separated by driveways, but the individual plots of all grain experiments are divided by paths, each forty inches in width. These paths keep the grain from mixing, permit the examination of each plot from all sides, and offer an easy method of harvesting the different crops separately.

The grounds referred to are situated directly at the rear of the main College building, and as there is a general slope of the land to the south-west an excellent view is obtained of nearly all the plots from the College buildings.

Clinton D. Smith, M. S., Director of the Experiment Station and Professor of Agriculture in the State Agricultural College, Michigan, when going through our trial grounds last summer, stated that he had visited twenty-two experiment stations, and he had no hesitation in saying that in magnitude and in systematic arrangement the experimental department of the Ontario Agricultural College was ahead of anything he had seen up to the present time.

New Experimental Building.

I wish to express my thanks to yourself and to the Minister of Agriculture for so clearly placing before the Government the necessity for a new experimental building. Through your influence there has been erected on the College grounds an excellent building for our work; and we are now prepared to do better work in the experimental department than at any time in the past. We have been much in need of this building for several years, and feel very grateful indeed that the Government has seen fit to erect one so well suited for our work. This new experimental building is situated on the College grounds, between the Convocation hall and the residence of the Experimentalist, and directly in front of the College barns. The front of the building is in a line with the front of the College building, Chemical Laboratory and Convocation hall. The main building is 70x45 feet, and will be nearly all used for experimental work. In the basement there are work rooms and storage rooms for fertilizers, grains, roots, potatoes, etc. The ground floor contains the office for the Experimentalist, a general office for workin g

up reports and for mailing purposes, a seed-testing room, a large work room, and a dark room for photography. The large hall on the second floor will be devoted to a permanent exhibit of experimental products, so arranged that visitors may inspect them at any season of the year. The building is made of white brick and is heated by steam brought through underground pipes from the main College building. During the past years farmers who visited the institution during the winter months had almost no opportunity of examining the different varieties of grain which are being tested in the experimental department. This has been a great disadvantage; but we hope soon to have many valuable object lessons for the farmers who visit the institution in the winter as well as during the summer months. Please accept my sincere thanks for giving us this opportunity of making our work of so much greater value to the farmers of Ontario.

Distribution of Seeds Throughout Ontario.

One of the most extensive systems of co-operative experimental work in agriculture to be found at the present time is the one established in Ontario. During the past year we distributed over 1,700 packages of grains, seeds and fertilizers to Ontario farmers. The varieties thus distributed were those which gave the best results in a number of years' trials in our experimental department. The whole system of co-operative experimental work is thus conducted in close connection, and in perfect harmony with our experimental work at the College. They go hand in hand; each made very much better by the help of the other. This work was started on its present plan in the spring of 1886, with twelve experimenters, who received grain and fertilizers, carried out the necessary instructions and reported at the end of the season. For the first two or three years the experiments were confined almost entirely to the ex-students of the Agricultural College; but, as many other farmers expressed a desire to join in the work, the invitation was extended to them also, and material was sent to those who applied on the condition that they would be careful to follow the necessary instructions and report the results of their tests after harvest. The work has steadily increased since its commencement, and during the past four years the demand has been so great that we have been unable to supply material to the full number of applicants. In 1891 there were 2,642 plots; in 1892, 5,688 plots; in 1893, 7,181 plots; in 1894, 7,721 plots; and in 1895, 9,179 plots used for these co-operative tests over Ontario.

The Ontario Agricultural and Experimental Union.

As the work of the experimental department of the College is most intimately connected with that of the Ontario Agricultural and Experimental Union, it might be well at this time to say a few words in regard to this Association. The chief objects of the Union are to cherish a bond of union among those who have been connected with the College; to establish a system of co-operative experimental work throughout Ontario; to invite the co-operation of the farmers in this work; and to hold an annual meeting at the College. It will be observed from what has already been stated that the co operative work in agriculture throughout Ontario is done conjointly by the Ontario Agricultural and Experimental Union and the Ontario Agricultural College.

Mr. T. B Terry, Hudson, Ohio, who is well known throughout Ontario as a leading farmer and agricultural writer, attended the meeting last year, and afterwards wrote a lengthy article in the *Practical Farmer* of Philadelphia, dated January 5th, 1895, descriptive of the work of the Union. From this article we quote the following: "I was greatly interested in the work of the Union, and had a grand time. I think all of you can see the great value of these experiments when carried on at many points scattered all over the State for a term of years. I would like to see such a union established in every State of this country. It was encouraging to see an audience composed of such bright wide-awake young men. I feel particularly indebted to the Secretary for giving me a chance to see these things with my own eyes and hear them with my own ears." For the report of the annual meeting of the Ontario Agricultural and Experimental Union, held at the Agricultural College on December 12th and 13th, 1895, the reader is referred to the latter part of this volume.

The Farm Department of the Ontario Agricultural College.

The farm department is under the immediate charge of Mr. Wm. Rennie, Farm Superintendent, and is entirely distinct from the experimental department. The two departments, however, very frequently receive assistance from each other. All crops handled for experimental purposes and for distribution throughout Ontario come under the care of the experimental department; and the crops grown for feed and for sale are looked after by the farm proper. All parties desiring to carry on co-operative experimental work, should write to the Experimentalist; and all those who wish to purchase seed grain in quantity, should correspond with the Farm Superintendent.

All varieties of farm crops, such as grain, potatoes, corn, roots, etc., which were grown in the farm department during the past year, had first proven themselves to be varieties of special merit through several years' trials in the experimental department; and in many instances the seed of these new and promising varieties had been previously supplied to the farm proper by the experimental department.

Experiment Stations Visited During the Year.

I wish to thank you in this public way for giving me the opportunity of visiting several experiment stations during the past season. Early in July, when vegetation was luxuriant, I visited the experiment stations at Ottawa, Canada; Burlington, Vermont; Orono, Maine; Durham, New Hampshire; Kingston, Rhode Island; Storr's School of Agriculture, Connecticut; and Cornell University, New York State. I had a very pleasant and valuable trip throughout, and received nothing but courtesy at each of the above-mentioned institutions. I made a special study of the various lines of experimental work taken up at these different institutions; and I feel sure that the points gathered here and there will enable us to do better work at this institution. I might say that the Agricultural Experiment Station of Amherst, Mass., is one well fitted for doing excellent work; but I believe that none of the institutions are better equipped for experimental work in agriculture than our own institution is at the present time.

Besides visiting the above-mentioned agricultural experiment stations, I had an opportunity of visiting a number of seedsmen's trial grounds during the past season. Among the seedsmen visited were Jas. J. H. Gregory, Marble Head, Mass; Rossin, Boston, Mass.; Jas. Vick's Sons, Rochester, New York; and J. S. Pearce, London, Ont. Mr. Gregory is an enthusiast in his work and carries on many trials of various kinds on his extensive grounds north-west of Boston. Mr. Rossin has ten acres of land under glass houses, besides two or three good-sized farms which he uses for his work.

Farmers Who Visited Our Experimental Grounds During 1895.

A large number of farmers visit the Agricultural College annually, and pass through and examine the work of the experimental department. We are pleased that agriculturists are enabled to visit the institution and examine for themselves the experimental work which is being carried on. We believe that this is increasing the interest in the reports which are issued annually. The best time to examine the crops when growing on the plots, is perhaps during the month of July, just before the winter wheat is harvested, as at that period none of the crops have been harvested, and nearly all have a fair growth, although some are yet quite small. A great many of the visitors come to the College between the time of haying and harvest. During the month of June of the present year thousands of farmers examined the crops which were under experiment at this place. There were only a few days during the month of June that the writer did not go through the experimental grounds from one to five times each day with parties varying in number from ten to 800 persons. The number and the variety of the questions asked during those trips are known to none better than to the writer. The person who obtains the greatest advantage from the trip through our trial grounds is he who, with pencil and book in hand, spends some time in close examination of the different crops on the various

plots. A visitor can obtain a fair knowledge of our experimental work even without a guide, as nearly every plot is plainly labelled. We believe that many very valuable object lessons can be obtained even during a day's visit at the College in the month of June.

Exhibits.

It has been the custom of the experimental department to prepare an exhibit for the leading exhibitions during each of the past seven years. An exhibit of nearly all the varieties of grain and corn was made at Toronto and London in each of the years 1889, 1890, 1891, and 1892. In the year 1893 an exhibit was taken to Chicago and arranged in the Agricultural Hall of the World's Columbian Exposition; and, owing to the time required for this exhibit, no display was made in Ontario. During the past two years our work has been so heavy at the time of the fall shows, that we have been unable to exhibit at any of the fairs in Ontario, except the Central Exhibition at Guelph. In September last an exhibit was made at Guelph of particular varieties of grain, millet, corn, roots, and fodder crops; the product of one pumpkin seed, from which was obtained twelve large-sized pumpkins, making an aggregate weight of 616½ pounds; and also of one squash seed, which gave nine well-developed squashes, making an aggregate weight of 551 pounds. Throughout the exhibition a person was in charge, to give information in regard to the results of the tests conducted in the experimental department, and in regard to the course of instruction given at the College.

Publications of the Year.

During the year 1895, the following have been prepared by myself for publication by the Department of Agriculture: A bulletin on winter wheat; the annual report of the experimental department of the Agricultural College; and the annual report of co-operative experiments in agriculture in connection with the Ontario Agricultural and Experimental Union. The following articles have also been prepared for the newspapers throughout Ontario: "Summary report of co-operative experiments with winter wheat;" "Crimson clover in Ontario;" "Growth of rape at the Agricultural College;" and "The Ontario Agricultural and Experimental Union."

Meetings Attended.

Since the first of December, 1894, the writer delivered addresses at the Dominion Sheep Breeders' Association, the Central Farmers' Institute of Ontario, the Ontario Agricultural and Experimental Union, and Farmers' Institute meetings in eighteen localities throughout York, Ontario, Peterborough, Victoria, Northumberland and Perth counties. It is encouraging to find an increasing interest in the various agricultural meetings from year to year.

Correspondence.

As time goes on, the correspondence in connection with the experimental work is becoming greater and greater. During the past year a great many letters have been received and answered relating to a large variety of agricultural subjects. To give some idea of the magnitude of the correspondence in connection with this department, it might be stated that during one week in September no less than 459 letters were received. This was perhaps the greatest number received in any one week. The increasing number of letters sent to this department may be taken as one of the strongest evidences of the growing interest in our experimental work; and I may say that we are always pleased to answer such correspondence to the best of our ability.

Grain Experiments.

The plots devoted to grain experiments during the past year number in all six hundred and fifty-four. These varied in size from one-sixth to 1-100 of an acre, but the majority were uniform in shape, each being one-tenth links wide, by 100 links long, thus-

being exactly 1 100 of an acre. Great care is exercised in having the plots in the separate experiments of a uniform size and shape. In all instances, the plots are in the form of a rectangle, and a stake is driven in each of the four corners of every plot. In the majority of cases, the grain is sown broad-cast. When this is done, a line is run around the different plots, and the packages of grain are then sown upon their respective plots, inside of the inclosures made by the line. Notes are carefully taken during the entire season, of the crops grown upon the various plots. Each crop is harvested when in the proper condition. As there are so many experiments in grain growing, it is necessary, during the greater part of July and August, to have the work along several lines conducted systematically during the same period. For instance, it is necessary to take notes and perform the various duties of cutting the grain, hauling the grain to the barn, threshing the crops, and cleaning up the threshed grain simultaneously. We are, however, now very well equipped to carry on these various lines of work at the same time. We have a waggon with a rack made specially for the work, by which the crops from two plots can be drawn from the field to the thrashing bar in a single trip, without the varieties being mixed, and with the loss of any grain through shelling. In the loft of the experimental barn, we have a large weighing scale with a platform six feet wide, by twelve feet long; and, in nearly all instances, we are enabled to weigh the product of a whole plot at one time. The threshing is done by means of a small separator, which was made specially for our work. As the separator is run by a tread power, and both the machine and power are situated in the barn, thrashing can often be done when the weather is unfavorable, providing the crops from a number of the plots have been stored in the barn a day or two before. It is necessary to run the little separator nearly every day for several weeks during the time of harvesting.

During the past year, grain experiments have been conducted in testing varieties, dates of seeding, methods of cultivation, selection of seed, application of fertilizers, and in growing grain separately and in mixtures.

Experiments With the Varities of Grain.

A great deal of attention has been given to the testing of the various varieties of grain crops within the past seven years. When we remember that nearly five million acres of land in Ontario are devoted to grain crops annually, and consider the great value it would be to the farmers of Ontario to have their crops increased in even a very slight degree, by the introduction of new and valuable varities, we feel justified in devoting a considerable amount of attention to this very important line of experimental work. Not only have we brought together and grown on uniform plots, side by side, for a number of years in succession all the leading varieties of crops which can be obtained in Ontario; but we have also imported leading varieties of grain from foreign countries, and have grown these in close proximity to our own Ontario varieties. Of nearly all kinds of grain we have been successful in obtaining a few foreign varieties surpass even the best of those obtained in Ontario, a fact which will be made evident by the study of the following pages of this report. Different varieties of grain have been imported from France, Germany, Italy, Sweden, Russia, England, Scotland, Switzerland, Hungary, Greece, Sicily, Egypt, Japan, New Zealand, Eugland, Australia, and the United States. Of these, Germany, France, New Zealand, and the United States have furnished some of the varieties which have given the best results in seven years' experiments.

In addition to growing varieties from Ontario and other places upon small-sized uniform plots situated side by side, the leading kinds are also grown on larger areas. The object of this is to increase the amount of seed of the leading varieties, for distribution throughout Ontario, and also to secure the seed to be used by the farm department of the institution. These large plots also assist in confirming the results of our experiments on the smaller lots. Besides growing the grain on the two different-sized plots, we put a certain number of kernels, usually fifty of each variety, in rows side by side. During the past season about 500 varieties of grain were sown in single rows of forty links in length. This assisted us very much in our observations of the various varieties under experiment. For instance, if we notice a variety badly rusted on a small plot, we

then examine the single rows; and if we find the same variety considerably rusted in this test as well as in the other, while those on both sides are free from rust, we are justified in concluding that this variety is liable to rust on our soil and in this locality. When we observe that a certain variety on the plots is becoming badly lodged, and also see that the same variety in the single rows shows weakness of straw, the two observations go to show the tendency of that variety towards weakness of straw. There are many other ways in which we can use the single row experiments in connection with the plot experiments, to obtain a more accurate and reliable knowledge of the various varieties under experiment. This method of investigation, when extended over a number of years, gives us reliable information regarding the various varieties of grain crops.

Barley, Comparative Test of Forty-one Varieties.

In 1895, forty-one varieties of barley were tested in the experimental department. Twelve of this number were six-rowed varieties, twenty were two-rowed, and nine were hulless. Eight of the varieties have now been grown in the experimental department for seven years in succession. In 1889, 1890, 1891, 1892, and 1893, thirty-seven kinds of barley were grown on the experimental plots side by side. After five years of careful testing, eleven of the leading kinds were selected, and the twenty-six varieties which had not given the best results were dropped out of the list. During the past year, we again dropped three of the eleven varieties grown for six years, so that we now have eight of the leading varieties grown for seven years, selected from thirty-seven varieties with which we started in 1889. We have also on our list six varieties which have been grown for six years. These are the best kinds among eight varieties which had been grown for five years previous to 1895. The varieties were all sown broadcast at the rate of 100 pounds of seed per acre, upon plots exactly one-hundredth of an acre in size. Equal amounts were sown on the different plots, seeding took place April 22nd and 23rd. The land, which might be termed average clay loam, was manured at the rate of twenty per acre of farmyard manure in the spring of 1894, and produced a crop of potatoes during that season. Each variety was harvested at its proper stage of maturity. The yields per acre have been estimated from the actual yield of the plots.

The barley crop was good during the year 1895, the six and two-rowed varieties giving an average yield of 57.5 bushels per acre. This yield surpassed that of 1894 by an average of about sixteen bushels per acre, and that of the average of the past six years by two bushels per acre. The weight per measured bushel for the past season was 53.5 pounds, which is exceedingly high for this part of the country. There is a great difference, however, in both yield of grain per acre and weight per measured bushel of the individual varieties. These facts can be readily ascertained by a careful study of the above table, where the yield per acre of both straw and grain, and the weight per measured bushel of each variety is given for the year 1895, and also for the average of the number of years in which each variety has been grown in the experimental department.

Within the past seven years no less than seventy-six varieties have been tested in the experimental department. Within the past two years, however, twenty-nine varieties have been discarded after five years' tests with each kind. The names of the varieties discarded in 1894 can be found in the College report for that year, on page 68, the varieties discarded during the present year are the Early Black from France, the Thanet from England, and the Improved Cheyne from England.

COMPARATIVE TEST OF THIRTY-TWO TWO-ROWED AND SIX-ROWED VARIETIES.

Varieties.	Seed obtained from.	Number of rows per head.	Results for 1895.				Average results for number of years grown on plots.		
			Date of maturity.	Weight per measured bushel.	Straw per acre.	Grain per acre.	Weight per measured bushel.	Straw per acre.	Grain per acre.
Grown for Seven Years.				lbs.	tons	bus.		tons	bus.
1. Mandscheuri	Russia	6	July 27.	51.66	2.05	73.10	50.89	1.83	**63.09**
2. Oderbrucker	Germany	6	" 24.	53.66	2.24	74.29	53 65	1.68	**58.08**
3. French Chevalier	France	2	Aug. 9.	54.88	1.95	66.86	52.39	1.91	**55.87**
4. Scotch Improved	Ontario	6	July 22.	53.33	1.52	55.34	51.87	1.50	**54.62**
5. Empress	England	2	Aug. 8.	55.13	1.94	70.31	52.68	1.69	**54.46**
6. Common Six-Rowed	Ontario	6	July 24.	54.00	1.44	58.92	52.53	1.42	**52.43**
7. Two-Rowed Italian	France	2	Aug. 6.	55.50	1.63	56.05	53.08	1.96	**49.02**
8. Kinna Kulla	Sweden	2	" 6.	53.88	1.78	48.63	51.94	1.78	**48.03**
Grown for Six Years.									
9. New Zealand Chevalier	New Zealand	2	Aug. 7.	54.00	2.22	72.07	52.98	2.00	**54.91**
10. Mensury	Ontario	6	July 22.	53.50	1.49	60 74	51.51	1.40	**53.56**
11. Early Minting	England	2	Aug. 6.	55.00	1.75	59.38	52.64	1.88	**52.72**
12. Cape	New Zealand	6	July 26.	49.50	1.35	43.55	47.68	1.39	**52.31**
13. Australian	Germany	2	Aug. 6.	54.75	2 22	59.51	53.20	1.86	**52.17**
14. Italian	Italy	2	July 31.	54.50	1.51	45.31	54.30	1.78	**49.85**
Grown for Five Years.									
15. Imperial Six-Rowed	Ontario	6	July 21.	53.33	1.91	84.83	52.23	1.57	**63.11**
16. Californian Brewing	United States.	6	" 26.	48.75	1.77	76.24	46.68	1.55	**62.32**
17. Six-Rowed Baxter's Improved	Ontario	6	" 24.	53.13	1.87	63.74	52.09	1.56	**54.36**
18. Californian Chevalier	United States.	2	Aug. 7.	55.00	2.96	66.28	52.26	2.14	**54.22**
19. Highland Chief	do	2	" 8.	55.00	1.71	58.97	52.84	1.73	**52.37**
20. Duckbill	Ontario	2	" 5.	54.50	1.67	46.16	52.76	1.69	**49.81**
21. Salzer's Californian Prolific	United States.	2	" 4.	54.00	1.60	51.89	52.77	1.65	**49.20**
22. Carter's Goldthorpe	England	2	" 12.	54.13	1.66	50.72	52.15	1.86	**47.88**
Grown for Four Years.									
23. Gold Foil Hansfords	United States.	2	Aug. 5.	55.00	1.81	65.20	52.74	1.96	**52.02**
24. Two-Rowed Canadian	Ontario	2	" 1.	54.13	1.59	51.37	52.65	1.63	**44.85**
25. Selected Canadian Thorpe	do	2	" 1.	53.25	1.63	50.91	51.73	1.65	**43.25**
Grown for Three Years.									
26. Four Rowed	United States.	6	July 28.	52.00	1.76	66 15	51.70	1.49	**56.53**
27. Vermont Champion	do	2	" 31.	55.25	1.61	53.71	53.96	1.72	**50.12**
28. Jarman's Selected Beardless	England	2	" 31.	55.00	1.92	61.84	51.87	1.92	**49.49**
29. Jarman's Golden Champion	do	2	Aug. 10.	53.66	1.79	55.63	50.91	1.71	**42.20**
Grown for Two Years.									
30. Scotch	United States.	6	July 23.	52.00	1.42	54.48	50.59	1.57	**55 25**
31. North-Western	do	6	" 26.	52.63	1.37	51.37	50 85	1.50	**48.15**
32. Success	do	6	" 18.	48.50	1.43	35.41	48.07	1.44	**37.56**

LEADING VARIETIES OF TWO AND SIX-ROWED BARLEY.

It will be observed by an examination of the foregoing table that the College has been very successful in importing new varieties, which have made an excellent record during the average of five or more years in the experimental department. Russia, Germany, France and New Zealand stand quite prominent in adding valuable varieties for cultivation in this province. It will be observed that the common six-rowed barley of Ontario is surpassed by several bushels per acre by some of the foreign varieties.

Mandscheuri. The Mandscheuri barley was imported from Russia by our College in the spring of 1889, and has been grown in the trial plots during each of the years since its importation. It is a six-rowed barley, and somewhat resembles the Mensury, which has been grown in Ontario and the United States for a longer period. Samples of the Mensury were obtained from different seedsmen in Canada and the United States, and were grown in our trial grounds for several years in succession, along with the Mandscheuri. We found that the Mandscheuri possessed longer heads, and had a more vigorous growth throughout, as well as surpassing in yield per acre, each of the samples of the Mensury barley which we secured. They were perhaps originally the same variety. In our experimental work the Mandscheuri which we imported from Russia gives considerably better all-round results than any samples of Mensury which we have been able to obtain in this country. Mandscheuri occupies first place in yield of grain per acre among all the varieties that we have grown at the experimental farm for seven years in succession, and it has given an average weight per measured bushel of about fifty-one pounds. Not only has it given the best yield among the varieties tested at our College, but, among five leading varieties distributed over Ontario for co-operative experimental work during the past four years, the Mandscheuri has headed the list in average yield per acre during each of those years In 1895 it was selected by the experimenters, by whom it was grown, as their choice of all the varieties tested. The straw of this variety usually grows to a good length, and is not apt to lodge. It is about three days later in maturing than the Common Six-Rowed variety. It will be observed that the Mandscheuri has given an average of eleven bushels per acre more than the Common Ontario Six Rowed in the experiments of seven years. In 1892 the Mandscheuri and the Common Six-Rowed varieties were two among five sent out over Ontario for testing purposes; and when the average results were made up it was found that the Mandscheuri had given about ten bushels per acre more than the Common Six-Rowed on the farms upon which they were tested.

Oderbrucker. The second variety on the list in average yield per acre for seven years is the Oderbrucker, which was imported from Germany in the spring of 1889. This variety is not quite so stiff in the straw as the Mandscheuri, and has produced an average of about five bushels per acre less than that variety; but a very strong point in its favor is the heavy grain which it produces. During the past seven years it has given an average weight of 53.6 pounds per measured bushel of grain, as compared with 50.9 pounds given by the Mandscheuri. It is interesting to observe that the Oderbrucker and the Mandscheuri, which were tested over Ontario during the past year, gave almost the same relative results in yield per acre over Ontario, as in the College tests for seven years. The Mandscheuri gave an average of 35.3 bushels per acre, and the Oderbrucker an average of 29 7 bushels per acre in the co-operative tests, which is 5 6 bushels in favor of the Mandscheuri.

Two-Rowed Italian. Although the Two-Rowed Italian occupies a lower place in yield per acre than the French Chevalier or Empress, which are also two-rowed varieties, still the Two-Rowed Italian has in its favor several points not possessed by the other two kinds. The Two-rowed Italian is one of the stiffest-strawed varieties of all those that have been tested at the Agricultural College during the past seven years. It will also be observed that the grain is of an excellent quality, as the average weight per measured bushel for seven years is a little over fifty-three pounds, while that of the French Chevalier and Empress is 52.4 and 52.7 pounds respectively. The Two-Rowed Italian was distributed over Ontario during the past season and gave nearly as large a yield per acre as the Oderbrucker, although it was not quite so popular among the experimenters as either the Mandscheuri or the Oderbrucker. Among the two rowed varieties the Two-Rowed Italian has made the best all-round record.

Imperial Six Rowed. The Imperial Six-Rowed barley, the seed of which was obtained in Ontario, has made a very good record indeed during the five years in which we have had it growing in the experimental department. It has produced a grain which has given on the average about 52 3 pounds per measured bushel. It is if anything a little earlier than the common six-rowed barley, and possesses a straw which weighs on the average about one-fifth of a ton more than that of the common variety.

Hulless Barley, Comparative test of Nine Varieties.

The Hulless barleys grown during the past year number nine varieties. They were sown on the same-sized plots, on similar soil, and at the same time as the two and six-rowed varieties which have been mentioned. The seed of the hulless varieties has been obtained from Hungary, Sweden, France, Germany, the United States, and Ontario.

Comparative Test of Nine Hulless Varieties of Barley.

Varieties.	Seed obtained from.	Number of Rows per Head.	Results for 1895.				Average results for number of years grown on plots.		
			Date of maturity.	Weight per measured bushel.	Straw per acre	Grain per acre.	Weight per measured bushel.	Straw per acre.	Grain per acre.
Grown for six years.				lbs.	tons.	bush.	bs.	tons.	bush.
1 Black Hulless	Ontario	6	July 26	63.25	1.83	54.90	63.53	1.61	**41.29**
2 Hungarian	Hungary	6	do 29	59.00	1.80	46.56	59.19	1.60	**40.41**
3 Guymalaya	Sweden	6	do 29	57.00	2 39	56.30	58.08	1.42	**39.93**
4 Large Skinned	France	2	do 22	60.63	2.05	51.72	60.11	1.55	**33.44**
5 Three Rowed	Germany	6	do 29	62.50	2.01	46.20	60.83	1.29	**28.39**
Grown for three years.									
6 Guy Mayle	United States.	6	July 24	60.88	1.73	60.52	62.15	1.32	**47.07**
7 Purple	do	6	do 26	63.33	2.05	55 94	63 46	1.84	**46 45**
8 Winnipeg No. 2	do	6	do 24	60.25	2.07	50.89	60.36	1.73	**42.22**
9 Smooth Hulless	do	6	do 29	62.00	2.15	34.84	62.17	1.76	**36.17**

The average yield per acre of the nine hulless varieties tested in 1895, was 50.9 bushels, allowing the standard weight per measured bushel to be forty-eight pounds. The weight per bushel of the hulless barley, however, is much greater than that of all the six and two rowed kinds. In 1895 the weight per measured bushel of the hulless varieties averaged sixty-one pounds.

Leading Varieties of Hulless Barley.

It will be observed from the foregoing table that the variety from Ontario heads the list in yield of grain per acre, but, in all-round results, varieties from Hungary, Sweden and United States have made good records, among those grown for three or six years.

Black Hulless. The variety of hulless barley which has been grown over Ontario for a number of years, and is known as the Black Hulless, now occupies the head place of the list in yield of grain per acre, among those grown for six years in succession. It has also given the heaviest weight of grain per measured bushel, the average for six years being 63.5 pounds. The greatest drawback to the Black Hulless is its exceedingly weak straw. A crop of this variety is very apt to be badly lodged, and at time of harvest the plants are frequently lying flat on the ground. On some soils, however, where there is not much trouble through the straw lodging, the Black Hulless might be grown very successfully for feed.

Hungarian. In 1889, the Hungarian barley was imported from Hungary and has now been growing for six years in succession in our trial plots. It possesses a very beautiful white grain, which, however, does not reach the sixty pounds per measured bushel. It usually stands up well, and where it has been grown over Ontario, has given fairly good satisfaction.

Guy Mayle. The Guy Mayle, which was presented to us through the kindness of the Experiment Station of Kansas, has given very good results indeed. During the three years in which it has been grown, it has given an average of forty-seven bushels per acre, and the grain has weighed a little over sixty-two pounds per measured bushel.

Comparative test of Forty-seven Varieties of Peas.

Varieties.	Date of maturity.	Results for 1895.			Average results for number of years grown on plots.		
		Weight per measured bushels.	Straw per acre.	Grain per acre.	Weight per measured bushel.	Straw per acre.	Grain per acre.
Grown for Five Years.		lbs.	tons.	bush.	lbs.	tons.	bush.
1 Early Britain	Aug. 12..	61.75	1.04	39.56	60.25	1.22	37.62
2 White Wonder	" 5..	64.50	1.11	41.40	63.12	1.09	37.03
3 Mummy	" 12..	61.25	1.62	43.37	63.63	1.55	36.45
4 Field (New Zealand)	July 31.	62.13	1.30	43 30	62 58	1.28	35 64
5 Brown (New Zealand)	Aug. 13..	60 75	1.25	40.97	59.58	1.49	35.05
6 Prussian Blue	" 15..	61.33	1.71	31.40	62.11	1.41	33.66
7 Princess Royal	" 7..	60.75	1.18	36.35	60 21	1.20	32 92
8 Blue (New Zealand)	" 12..	64 25	1.00	35.75	62 40	1.17	31.73
9 White Eyed Marrowfat	" 12..	63.13	1.28	33.98	62 16	1.40	31.35
10 Black Eyed Marrowfat	" 12..	61.88	1.00	29.13	61.46	1.34	31.19
11 Glory	" 5..	62.50	1 51	49.58	61.33	1.29	31.04
12 Early Racehorse	" 7..	60.50	1.22	34 27	62.43	1.24	30.89
13 Multipliers	" 14..	62.13	1.71	33.13	61.89	1.59	29.69
14 Sweet Jessie	" 12..	61.13	1.06	35.50	62 03	1.08	29.66
15 Hero of Reading	" 1..	63.75	1.34	41.98	60.84	1.15	28.17
16 Perfection White	" 5..	61.13	1.19	37.73	60 01	1 21	27.53
17 Selected Maple	" 5..	60.13	.80	24.27	61.87	.71	26.37
Grown for Four Years.							
18 Tall White Marrowfat	" 12..	62.88	1.49	42.72	61.59	1.68	37.35
19 Canada Cluster	" 13..	63.25	1.50	32.47	62.31	1.63	33.45
20 New Canadian Beauty	" 12..	61.33	1.32	35.87	61.74	1.39	32.91
21 Cleveland's Advancer	" 14..	61.33	1.58	34.95	60.60	1.44	32.41
22 Royal Dwarf Marrowfat	" 13..	62.00	1 59	37.97	60 79	1 55	31.91
23 Early June	" 13..	62.00	1.50	38 23	62.44	1.45	31.89
24 Centennial	" 16..	61 33	1 46	34.55	61.16	1.29	31.87
25 Golden Vine	" 13..	61 25	1.17	31.88	61.77	1.46	31.73
26 McLean's Advancer	" 12..	54.63	1.16	34.77	54.08	1.02	31.17
27 Scotchman	" 15..	61 75	1.98	33.23	62 40	1.87	30.74
28 Prince Albert	" 24..	61 50	1.77	40 10	61.70	1.57	29.42
29 Sword	" 13..	61.33	1 58	40.78	61.87	1.44	29.35
30 Potter	" 12.	60 13	1.54	41.10	60 77	1 27	27 89
31 Canada Field	" 19..	61.33	1.40	36.53	61.11	1 35	27 62
32 Oakshott Field	" 28..	54.25	2 25	38 33	53.70	1 60	25.00
33 Striped Wisconsin Blue	" 14..	62.50	2.00	39 90	62.52	1 45	23.80
34 Pride of The North	" 5..	63.00	1.07	25.22	59.69	1.03	21.26
Grown for Three Years.							
35 Chancellor	July 30..	65 00	1 52	53.55	63 88	1.41	38.88
36 Egyptian	Aug. 19..	63 00	.99	48 80	60.50	1 03	38.03
37 Nimble Taylor	" 13..	60 50	1 56	49 55	59 05	1 31	37 46
38 William The First	July 31.	59 75	1.35	46 62	59 56	1 12	35 47
39 Common Gray	Aug. 13..	58.33	1.90	42.47	58 28	1 48	31 61
40 Fine Pod	" 13.	60 25	1 53	43.98	59 04	1.40	33.93
41 D'Auvergne	" 1..	65 00	1 43	44 95	62.50	1.16	32 06
42 Tall Turkish	" 7..	61 88	1 17	41 82	61 02	1.23	30 47
43 White Imperial	" 13..	59.00	2 04	44.62	60.65	1.37	30.29
Grown for Two Years.							
44 Improved Gray	Aug. 13..	60.13	1.42	51.22	60 69	1.19	38.83
45 Crown	" 12..	61 00	1 64	42 13	61.13	1.60	31.19
46 Coffee	" 15..	59.00	2 04	35.02	60.13	1.64	27.60
Grown for One Year.							
47 White Hundredfold	.....	61.75	1.78	52.39	61.75	1.78	52.30

Forty-seven varieties of peas were grown in the experimental department in 1895. Of this number, seventeen varieties have been grown on plots side by side for five years in succession, seventeen for four years, nine for three years, three for two years, and one for one year. Seed of all varieties was sown on the 24th of April upon plots exactly one one-hundreth of an acre in size. The soil on which the peas were grown during the past season was a clay-loam, and the land had a gradual slope towards the south-west. Potatoes were grown on the same plots in 1894. The seed was put in with a grain drill, in order that it might be evenly covered The quantity of seed sown averaged from two to five bushels per acre, according to the size of the grain and the manner of growth of the various kinds. The yields per acre have been estimated from the actual results of the plots.

The yield of peas per acre during the past season was very good indeed, the highest yield being 53 5 bushels per acre, and the lowest 24.5 bushels per acre. The weight per measured bushel was also good during the past season, as we find that five varieties gave an average weight of over sixty-four pounds per measured bushel.

Leading Varieties of Peas.

As in the case of barley, we find that some of the foreign varieties have given very excellent results in comparison with those which have been grown in Ontario for a number of years. The best yielding variety among those grown for five years was one obtained from England, and the second best yielding variety was obtained from New Zealand, while the third is an Ontario variety.

Early Britain. The Early Britain variety of peas was imported from England in the spring of 1889, and in the average yield per acre of all the varieties grown successfully in our trial plots for five years in succession, it heads the list. The straw is of medium length; the pea is brown and a little flattened at the sides. The blossom is purple, and, when the plants are in bloom, the crop presents a very handsome appearance. It is about the same as Golden Vine in its time of ripening, but has given an average of over five bushels per acre more than the average of the Golden Vine during the four years in which the latter variety has been in our trial plots.

The Early Britain has not yet been sent out over Ontario for co-operative experimental work owing to the limited quantity of this variety in our possession.

White Wonder. Among a number of varieties of peas which were imported from New Zealand a few years ago, the White Wonder has made the best record, and stands second in point of yield of grain among all our varieties grown for five years. It is surpassed by the Early Britain by a little less than two-thirds of a bushel per acre. The grain is smooth and white, and is somewhat smaller in size than that of the Early Britain; and its weight per measured bushel, during the past five years, has been upwards of sixty-three pounds. It is about one week earlier than the Golden Vine in reaching maturity. The number of pods per plant of this variety averaged from seventeen to thirty-three, in 1895. This variety has not yet been sent out over Ontario in connection with the system of co-operative experimental work, owing to the supply of seed being too limited.

Mummy. The variety of peas obtained in Ontario which has given us the largest yield per acre, among the varieties grown for five years, is the Egyptian Mummy. This kind has made a very good all round record, its average yield per acre being over thirty-six bushels and its average weight per measured bushel being 63 6 lbs., which is one of the highest weights of the varieties which we have had under experiment. The straw also grows long and is of a rather coarse nature. In wet seasons the Egyptian Mummy shows a tendency to mildew to a considerable extent. The season of 1895 appeared to be well suited to the Egyptian Mummy variety as it gave a weight per measured bushel of upwards of sixty four pounds. In the co-operative work over Ontario during 1895 the Egyptian Mummy gave the highest yield per acre among four leading varieties which were tested on seventy-two different farms. The results however were very similar to

those of the Prussian Blue variety, and these two might be considered as practically the same in regard to yield of grain per acre. The Prussian Blue however was rather more popular among the experimenters than the Egyptian Mummy.

Prussian Blue. It will be observed in the list that the Prussian Blue now occupies sixth place in the yield of grain per acre, among the varieties grown for five years. During the past season it did not do so well as a large number of other varieties. This seems to have been due partly to injury received from the frost in the early part of May, at which time the plants were about two inches in height. But the Prussian Blue variety has made a very good all round record during the past five years at the Agricultural college. In the co-operative experiments over Ontario, the Prussian Blue has been one of the four varieties sent out during each of the past three years, and it gave the largest yield per acre in 1893 and 1894, and during the past season it was surpassed to only a very slight extent by the Egyptian Mummy.

Chancellor. The Chancellor variety of peas, which was obtained from the United States three years ago, has made a very good record indeed, and during the past season has given the largest yield of grain of any variety under experiment, with but one exception. It has alse given the best average weight of grain per measured bushel of the varieties tested since 1889. The vines are of medium length and the pods are quite small The individual peas are perhaps the smallest in size of any variety that we have been testing. They are very smooth, white and round, and worthy of further trials.

Egyptian. One of the most peculiar varieties of peas that we have had any experience with is the Egyptian, or what is sometimes called the Brazilian coffee pea The growth of this variety is upright, and the branches, which extend from the main stocks, are very numerous. The crop usually grows to a height of about one foot, and has blossoms which are beautiful and white. There is usually only one pea in each pod; but, during the past season, we found in many instances two, and in some cases three peas enclosed in a single pod. The grain is of large size and of a yellowish color. The straw is apt to be coarse, and is not relished by animals, but the grain should make good feed. It is claimed for this variety that the grain is one of the best substitutes for coffee.

Spring Wheat—Comparative Test of Fifty-two Varieties.

In the past seven years no less than seventy-nine varieties of spring wheat have been tested in the experimental department at the College. After growing twenty-two of those varieties during the years 1889, 1890, 1891, 1892, and 1893, thirteen of the less profitable kinds were dropped from the list, and the experiments were continued with the nine leading varieties. Among twenty-one varieties which were grown in 1890 for the first time and during each following year up to the present season, eleven of the poorest kinds were dropped from the list in the spring of 1895, and the ten leading varieties were again sown the past season. From this it will be seen that during the two years no less than twenty-five varieties of spring wheat have been dropped from our experimental list, after they had been tested for five years in succession. New varieties have been added year by year, and now the number of those under experiment is upwards of fifty. The varieties of spring wheat were all sown on the 20th of April, 1895, on plots exactly one one-hundredth of an acre in size. The land on which the spring wheat was grown produced a crop of roots in 1894. Before the roots were sown the land received a dressing of twenty tons of farm-yard manure per acre, which was the first it had received for at least six years. The grain was sown broadcast, and at the rate of 120 pounds per acre. The yields per acre have been estimated from the actual yields given by the plots.

The fifty-two varieties of spring wheat gave an average yield of 26.7 bushels of grain per acre during the past season. This is an intermediate yield between that produced by the spring wheat in 1894 and in 1893, as in the former year, the average was 30.3 bushels per acre, and in the latter 21.1 bushels per acre. When we consider that the old varieties of spring wheat appear to be failing in many parts of the province, we can but hope that some of the leading varieties imported from foreign countries, as well as some of the best in Ontario, may, under good cultivation, still produce fairly satisfactory yields.

COMPARATIVE TEST OF FIFTY-TWO VARIETIES OF SPRING WHEAT.

Varieties.	Nature of head.	Results for 1895.			Average results for number of years grown on plots.		
		Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.	Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.
Grown for Seven Years:		Lb.	Tons.	Bush.	Lb.	Tons.	Bush.
1 Bart Tremenia	Bearded	63.00	2.26	46.35	62.85	1.81	**30.08**
2 Herison Bearded	"	62.50	1.56	28.85	63.20	1.97	**29.23**
3 Pringle's Champion	"	58.63	1.60	28.36	60 28	1.89	**27.15**
4 Saxonka	"	60.00	1 86	28.05	60.46	1.81	**25.58**
5 Konisburg	"	60.50	1.67	30.03	61.47	1.66	**25.11**
6 Holben's Improved	Bald	59.25	1.65	27 40	58.85	1.84	**24.70**
7 Summer	Bearded	59.00	1.58	28.91	58.00	1.77	**23.98**
8 Odessa Ghirka	Bald	61.50	1.74	31.28	59.88	1.87	**23.79**
9 Ordinary Bearded March	Bearded	60.00	1.39	26.04	58.18	1.77	**23.07**
Grown for Six Years:							
10 Wild Goose	Bearded	62.33	2.43	55.78	61.21	2.04	**35.90**
11 Red Fern	"	58.50	1.41	29.09	61.06	2 07	**32.67**
12 White Russian	Bald	57.63	1.90	31.64	58.97	1.97	**31.55**
13 Medeah	Bearded	61 00	2.26	43 02	60 96	1.73	**29.37**
14 Red Fife	Bald	59.00	1.83	32.24	61.32	1.87	**28.49**
15 Sorentino	Bearded	60.00	2.56	40.42	59.78	1.84	**28.05**
16 White Fife	Bald	59.25	1.82	31.12	61.32	1.68	**27.59**
17 Algiers	Bearded	57.13	2.04	39.58	58.00	1.85	**27.34**
18 Mountain	Bald	58.88	1.80	28.41	58.81	1.91	**25.85**
19 Colorado	Bearded	59.00	1.57	25.99	59.96	1.74	**25.09**
Grown for Five Years:							
20 McCarlin	Bearded	59.13	1.68	30.78	59.18	2.09	**28.40**
21 Manitoulin	Bald	58.88	1.66	31.46	59.71	1.72	**28.01**
22 Rio Grande	Bearded	60.13	1.81	30.39	59.51	1.91	**27.94**
23 Okanagan Valley Velvet Chaff	Bald	57.50	1.59	24.53	55 04	1.82	**27.01**
24 Saskatchewan Red Fife	"	58.33	1.21	21.25	59.44	1.66	**25.37**
25 Washington	Bearded	59.13	1.48	27 27	59.49	1.65	**25.16**
26 Salzer's Assiniboia Fife	Bald	59.33	1.22	23 46	59.19	1.50	**25.06**
27 Pringle's Defiance	"	60 00	1.00	19.22	58.81	1.39	**20.68**
28 Anglo Canadian	Bearded	59.50	1.05	17.53	55.12	1.51	**17.57**
Grown for Four Years:							
29 Wellman Fife	Bald	60.13	1.38	27.27	59.25	1.97	**29.90**
30 Lost Nation	"	60 33	1.32	26.93	59 66	1.95	**29.66**
31 Velvet Chaff Blue Stem	"	57.50	1.86	30 50	58.17	1.95	**29.24**
32 New York	Bearded	57.13	1.44	21 09	58.59	1.75	**25.36**
33 Manitoba Red	Bald	60.25	1.11	22 03	59 64	1.73	**25.14**
34 Haynes' Blue Stem	"	56 00	1.67	19 40	57 50	1.84	**25.08**
35 Dakota Marvel	"	57.25	1.44	23.65	57.33	1.76	**23 40**
36 Campbell's White Chaff	"	57.75	.87	16.04	55.09	1.39	**16.82**
Grown for Three Years:							
37 Blue Democrat	Bearded	60.00	1.89	33.80	59.65	2 02	**28.43**
38 Amythest	Bald	61.00	1.40	25.68	59.73	1.59	**24.45**
39 Champion Bearded	Bearded	59 88	1.54	25 23	59.13	1 83	**23.95**
40 Ontario	"	58.00	1 82	28 54	57 77	1.71	**22.94**
41 French Imperial	Bald	60.50	1 18	24.00	59 40	1 45	**22 53**
42 Early Scotch Bearded	Bearded	59.75	1.35	18 36	58 56	1 64	**20.69**
43 Scotch Fife	Bald	60 33	1.07	20.89	59.21	1.28	**18.72**
44 Canadian Club	"	59.79	.98	18.18	57 75	....	**18 15**
45 Niagara	"	60.00	.97	20 05	55.13	1.34	**15.88**
46 White Australian	"	58.00	.94	16.98	52.19	2.06	**11.92**
Grown for Two Years:							
47 Salzer's Marvel	Bald	57.25	1.28	18 91	58.16	1.64	**25.45**
48 May's Early Wonder	"	60.50	1.18	22 45	60 57	1 55	**24.43**
49 Cubana	"	60 00	.88	18 23	59.53	1.48	**21 64**
50 Pillsburg	"	60.25	.95	20 94	59 78	1 31	**21.33**
51 Red North Dakota	"	60.00	1.00	20.10	59.63	1.28	**23.39**
Grown for One Year:							
52 Manitoba Hard	Bald	60.25	.84	16.25	60 25	.84	**16.25**

Leading Varieties of Spring Wheat.

Some of the best varieties of spring wheat are those which have been imported from other countries. France, Germany and Sweden might be named as supplying some of the varieties which have given the best all-round results.

Bart Tremenia. The Bart Tremenia variety of spring wheat was imported from Sweden by our College in the spring of 1889, and has been grown in the experimental department during each of the years since that date. It produces a long straw of rather a wiry nature. The grain is large but of a coarse quality, somewhat resembling that of the Wild Goose variety. Not only has the Bart Tremenia given the largest average yield of grain per acre among the different varieties grown in the experimental department for seven years in succession, but it has produced a grain which has given an average weight per measured bushel of nearly sixty-three pounds. The Bart Tremenia was distributed over Ontario as one of the five leading varieties for testing in 1895. It, however, did not do well over the Province, being surpassed in yield of grain per acre by the Herison Bearded, Red Fern and Pringle's Champion. Of the five varieties sent to experimenters it was the most unpopular this season.

Herison Bearded. The variety of spring wheat which stands second in yield per acre among the varieties grown for seven years is the Herison Bearded, the seed of which was imported from France by our College seven years ago. Not only has it given the largest yield of grain per acre, but it has also produced a grain which has given the largest average weight per measured bushel among all the varieties tested. Fifty-seven varieties of spring wheat were submitted to a deputation of the Dominion Millers' Association, and the Herison Bearded was selected as one of the nine first-class milling wheats. The kernels of this variety are small, being short and thick, and they are of a darkish red color. The straw grows to a fair length, and usually stands up well. The heads are of a club shape, and the kernels are very compactly arranged in the heads. The Herison Bearded has been distributed over Ontario for three years in succession as one of the Union varieties. In 1893 it occupied third place in yield per acre, and in 1894 and in 1895 it headed the list each year among the varieties sent out. In 1894 it gave an average of five bushels per acre more than the variety coming next to it, and during the past season it gave an average of three bushels per acre more than the average variety, which gave the second highest yield of grain per acre. The Herison Bearded was selected by the majority of the experimenters during the past season as being their choice among the five varieties which they had received.

Pringle's Champion. The third place in yield of grain per acre, among the varieties of spring wheat grown for seven years, is occupied by a German variety known as Pringle's Champion. This variety has given an average of two bushels per acre less than the Herison Bearded, and has produced a grain which weighs about three pounds per measured bushel less than the variety just mentioned. It was also selected by the Millers' Association as being one having good milling qualities. The straw of this variety is usually quite stiff, and the heads are of good length, nearly double those of the Herison Bearded in this respect, but at the same time the number of grains per head is usually less than that of the Herison Bearded. In 1895, Pringle's Champion had an average of 10.3 heads per plant, the Bart Tremenia 10.7, and the Herison Bearded 11.2. The experimenters over Ontario who received spring wheats during the past year found the Pringle's Champion to be one of the number for testing purposes. The average results for the season show this variety to occupy third place in yield of grain per acre, having about four bushels per acre less than the Herison Bearded.

Wild Goose. Although the Wild Goose variety of wheat is very coarse in quality, it is a good yielder, and heads the list, in that respect, among the varieties we have grown for six years in succession. In the trials of six years it has given an average of nearly thirty six bushels per acre, and the average weight per measured bushel has been upwards of sixty-one pounds. The Wild Goose has been grown for some time over Ontario; but it possesses a poor quality of grain and usually sells for less than other varieties of spring wheat.

Red Fern. The Red Fern variety of wheat is one of the best of those which have been grown in Ontario for a considerable length of time. It has produced an average of thirty-two and two-thirds bushels per acre in the average of six years' experiments, and the grain has overrun in weight per measured bushel, "the standard of Ontario," by a little over one pound. Red Fern has been surpassed, however, in the co-operative experimental work over Ontario for two years in succession by the Herison Bearded variety.

Experiments with Winter Wheat.

The following Bulletin on Winter Wheat was issued in August, 1895 :

One hundred and ninety-seven plots were used for winter wheat experiments at the Ontario Agricultural College during the past season. About one-half of this number was used for testing varieties, and the remainder for testing different dates of seeding, methods of seeding, selections of grain for seed, quantities of seed per acre, the yield and quality of wheat cut at different stages of ripeness, and the value of seed from wheat cut at different stages of maturity. This bulletin gives a concise report of the principal results of these tests, and it also gives the average results of some of the experiments which have been conducted for a number of years past.

Field Conditions. The plots used in 1895 for the winter wheat experiments were situated in the northern portion of the large experimental field which lies to the rear of the main College building. The land has a gentle slope to the south-west and its position is somewhat elevated. Hence it was considerably exposed to the cold winter winds, which were so prevalent last season. The soil, which is an average clay loam, was prepared on the bare fallow system, and received a coating of fifteen tons of farmyard manure per acre in 1894. The plots were all the same size, each containing exactly one-hundredth of an acre. The yields per acre have been determined by the actual yields of the plots.

Conditions of Season and Growth. The grain for the various winter wheat experiments was sown early in September. The germination of the seed was good, and the growth upon the different plots during autumn was quite satisfactory. There were very frequent, strong, cold winds during the winter, and the snow was so often blown from the plots that they were only very thinly covered during the greater part of the cold weather. As the slope in the land extends throughout the whole length of the plots, there was no chance for water to lie upon any part of them, but a considerable amount of sleet which came in the early spring, along with the influence of the cold weather, seriously injured many of the less hardy varieties. Between the 12th and 22nd of May, there was frost on six different nights, and on one occasion a minimum thermometer on the College grounds registered only twenty-two degrees above zero. This late spring frost checked the growth of the crop considerably, but did not seem to do much injury further than this.

The past year has furnished us an excellent opportunity for studying the comparative hardiness of the different varieties under test, and some valuable object lessons under this head were furnished the thousands of Ontario farmers who visited the College in the month of June and witnessed the work which is being carried on in the experimental department.

Varieties Tested. One hundred and two varieties of winter wheat were under test. The plots, as already intimated, were situated side by side and were exactly uniform in size. They were separated from each other by paths three feet wide. All the varieties were sown by hand at the rate of two bushels per acre, on September 6th, 1894, and the germination was quite uniform throughout. The varieties ripened between the 16th and 24th of July, which was about a day later than in 1894. The amount of rust and smut was small this season.

The following table gives the number of varieties tested and reported on within the past six years and also the average yields for each of these years :

Year.	Number of varieties grown each year.	Average weight of grain per measured bushel.	Average yield of—	
			Straw per acre.	Grain per acre.
		lb.	tons.	bus.
1890	15	60.0	2.4	30.9
1891	23	63.3	2.0	52 9
1892	44	60.5	3.2	42 6
1893	52	58.4	2.1	29.9
1894	80	60.8	4.0	46.7
1895	102	60.4	1.2	26.1

It will be observed that there are great variations in the average results for the different years as given in the above table. The highest record in quality and yield of grain was made in 1891. That year an excellent opportunity was given for a comparison of the different varieties when grown under climatic conditions very favorable for the best development of the plants. In the years 1892 and 1894, much valuable information was obtained in regard to the comparative strength of straw, as many of the varieties were badly lodged, while others, growing beside them, stood upright until ripe. In 1890, 1892 and 1893, there was a considerable amount of rust on our winter wheat ; but, as many of the varieties were much more affected than others, we are enabled to make some valuable comparisons. Almost all the varieties came well through the winters from 1890 to 1894, but in 1895 many of them were very much winter-killed, while others, growing beside and between the injured ones, sustained little or no injury.

The varieties of winter wheat which are most desirable for cultivation in Ontario, are those which possess the greatest number of good and the least number of bad qualities. To compare the different varieties in this respect is the object of the present bulletin. From what is said in the preceding paragraph, the reader will readily understand that it is of great importance to have these experiments extend over a period of *several* years, in order to have the varieties subjected to various climatic conditions.

Characteristics and Yields of Varieties. The following table contains the characteristics and the yields of one hundred and two varieties tested during the past season. The horizontal rows give information regarding the different varieties, and the perpendicular columns furnish a means of comparing the characteristics and yields of the varieties with one another. Starting at the left hand side of the table, columns one and two give the numbers and names of the varieties ; three and four refer to their characteristics ; five, six, seven and eight give results for 1895 ; and nine, ten, eleven and twelve give average results for four, three and two years, or for one year, as indicated in column number two. Of the first fifty-three varieties mentioned in the table, we have grown some for six years, others for five years, and the remainder for four years ; but, to allow a better comparison of the varieties, the average results of only the last four years are here presented.

The reader's attention is especially directed to the last column on the right hand side of the table, as this gives the average yield of grain per acre of each variety for the number of years reported upon, and the varieties are arranged in the table according to these average yields, starting with the highest and finishing with the lowest.

There is, perhaps, not a winter wheat grower in Ontario but is quite familiar with some of the varieties herein reported upon, as many of the old varieties have been tested along with the newer kinds. The following table furnishes an excellent opportunity for each farmer to compare the respective merits of the varieties which he has not grown, with those of the varieties with which he is familiar.

Characteristics and Yields of 102 Varieties of Winter Wheat.

Varieties.	Heads bearded or bald.	Color of grain.	Results for 1895.				Average results for number of years reported upon as shown in first column to left.			
			Condition of crop in spring of 1895.	Weight per measured bushel.	Straw per acre.	Grain per acre (bus. 60 lbs.)	Amount of straw lodged.	Weight per measured bushel.	Straw per acre.	Grain per acre (bus. 60 lbs.)
Grown for four years:				lbs.	tons.	bus.	p. c.	lbs.	tons.	bus.
1 Dawson's Golden Chaff	Ba.	W.	very good	59.9	1.8	40.3	2	59.5	2.9	48.7
2 Early Red Clawson	Ba.	R.	good	58.8	1.6	39 9	51	58 4	3 2	45.5
3 Egyptian	Be.	R.	good	60 7	1.9	40 6	31	60 6	2.9	45 1
4 Golden Drop	Ba.	R.	medium	59 3	1.4	31.5	51	61.2	3.2	43 7
5 Surprise	Ba.	W.	good	57.4	1.8	35.4	22	58 6	2.9	43.0
6 Reliable	Be.	R.	very good	61 1	1.8	35 9	15	61.5	2.8	42.0
7 American Bronze	Ba	R.	very good	60 6	1.9	38.9	2	59.1	3.0	41.9
8 Bulgarian	Be.	W.	good	60 6	1.3	28 7	19	61.3	2.6	41 3
9 Jones' Winter Fife	Ba.	R.	good	59.9	1.5	31.3	15	59.5	2.6	41.2
10 Golden Cross or Volunteer	Be.	R.	medium	60 9	1.8	36.4	27	60 3	3.2	40.6
11 Standard	Ba.	W.	good	59.9	1.7	40.3	14	58 3	2.8	40.5
12 Manchester	Ba.	R.	good	61.5	1.5	34.9	23	60 4	3.0	40.4
13 Red Velvet Chaff	Ba	R.	very good	59 0	2.2	39.5	38	57 8	3.5	40.2
14 Bonnell or Landreth	Ba.	W.	good	59.9	1 8	38 7	29	58.7	3.1	40 0
15 Russian Amber	Be.	R.	medium	60.1	1.5	30.4	23	61 0	2.6	39.9
16 Walker's Reliable	Be.	R.	medium	60.5	1.1	28 0	26	60.8	2 7	39.0
17 Democrat	Be.	W.	good	62.3	1 2	29.3	17	61.5	2.3	38.8
18 Winter Pearl	Ba.	W.	good	62.3	1 7	35 0	16	61.2	2 5	38.6
19 Seneca or Clawson	Ba.	W.	good	59 3	1.7	33 8	29	58 9	3 0	38.6
20 Red Lion	Be.	R.	good	59.5	1 7	33.7	68	60 7	3 3	38.5
21 Martin Amber	Ba.	W.	good	61 9	1.5	32 7	37	60.3	2 9	38.2
22 Canadian Velvet Chaff	Ba.	W.	good	57 6	1.5	29 1	16	57.2	2.6	37.7
23 Garfield	Ba.	W.	good	60 8	1.5	30 6	24	59 7	2.4	36.8
24 Hybrid Mediterranean	Be.	R.	very good	62.3	.9	22 0	35	60 9	3 1	36.8
25 New Monarch	Ba.	R.	good	59.6	1.5	29 8	25	60 1	2 8	36.7
26 Mediterranean	Be.	R.	medium	60 6	1 3	30 8	36	60 6	3 0	36.3
27 Manilla	Ba.	W.	very good	60 1	1 5	34 3	15	58 0	2.6	36.1
28 Lancaster	Be.	R.	very good	61 0	1 1	24 6	67	60 9	3 0	36.0
29 Rutherford	Be.	R.	medium	61.0	1 1	26 3	35	60 0	2.9	35.9
30 Rogers	Ba.	R.	very good	60 6	1.0	25.1	38	59.9	3 0	35.9
31 Fultz	Ba.	R.	good	62.2	1 1	25 0	5	62 4	2.1	35.3
32 Valley	Be.	R.	poor	60 1	.6	13 7	11	60 6	2.3	34.8
33 Monette	Ba	R.	medium	60 0	1.2	27 2	20	59 3	2 4	34.6
34 Hybrid Diehl	Ba.	W.	medium	60.6	1.1	24.9	21	59 4	2.2	34.6
35 Genesee	Be.	W.	medium	60.0	.9	21 5	20	60 1	2.4	34.1
36 Scott	Ba.	R.	very good	61.3	1.4	34 2	13	60 1	1.4	33.6
37 Velvet Chaff	Be.	R.	medium	62 8	1.1	25.8	3	62 5	2 2	33 2
38 Longberry Red	Be.	R.	medium	60.3	.9	21 7	44	60 4	2.5	32.8
39 Deitz Longberry	Be.	R.	medium	61 6	1.1	26 0	24	61.8	2.4	32.5
40 Rumsey	Be.	W.	medium	60.0	.5	10.5	21	60 5	2.5	32.3
41 Red Wonder	Be.	R.	medium	61 8	.9	22 3	36	61 7	2.9	32.0
42 Fulcaster	Be	R.	medium	59.8	1.3	10 3	27	61 6	2.7	28.4
43 Red Russian	Ba.	R.	poor	61.4	...	21 8	5	60.2	2.3	27.9
44 Saumur	Ba.	R.	medium	57 1	1.0	23.7	13	53 5	2.2	27.1
45 Red Inversible	Ba.	R.	medium	59.9	.7	14 0	20	56 1	2 3	26.4
46 Spalding Red	Ba.	R.	medium	61 9	.7	19.1	22	58.8	2.3	26.2
47 Browick Red	Ba.	R.	medium	60 9	.9	26 5	13	54 8	2.2	25.2
48 Square Head	Be.	W.	very good	60 0	.7	16.0	17	59 2	.7	24.5
49 Regent	Ba.	R.	good	59 3	1.5	29 1	27	53 8	2.5	23.2
50 White Patanelle	Ba.	W.	very good	59.6	.5	6.2	11	53 4	2.4	21.5
51 Dividend	Ba.	R.	medium	58 8	.8	17 7	33	51.7	2.4	21.1
52 Galizien Summer	Ba.	R.	good	59 6	.8	16 6	23	55.1	1.7	20 9
53 Kessingland Red	Ba.	R.	medium	58.7	.8	20.7	13	51.2	2.0	20.4

CHARACTERISTICS AND YIELDS OF 102 VARIETIES OF WINTER WHEAT —*Concluded.*

Varieties.	Heads bearded or bald.	Color of grain.	Results for 1895.				Average results for number of years reported upon as shown in first column to left.			
			Condition of crop in spring of 1895.	Weight per measured bushel.	Straw per acre.	Grain per acre (bus. 60 lbs.)	Amount of straw lodged.	Weight per measured bushel.	Straw per acre.	Grain per acre (bus. 60 lbs.)
Grown for three years:				lbs.	tons.	bus.	p. c.	lbs.	tons.	bus.
54 Stewart's Champion	Ba.	R.	very good	60.4	2.2	43.5	5	58.6	2.9	**38.9**
55 Early White Leader	Ba.	W.	medium	59.8	1.2	27.5	5	57.4	2.2	**38.2**
56 Soule's	Ba.	W.	good	58.8	1.4	31.5	7	56.9	2.6	**36.8**
57 South Sea	Ba.	W.	medium	59.4	1.1	23 8	3	59.9	1.9	**35.0**
58 Eureka	Ba.	W.	good	59.0	1.4	28 1	6	57.7	2.3	**34.3**
59 White Star	Be.	R.	medium	61.3	1 2	32.5	7	60.1	2.1	**34 0**
60 British Columbia	Ba.	R.	medium	60.9	1.1	24.4	.....	57 6	2.0	**28.4**
61 Treadwell	Ba.	W.	very poor	59.0	.5	11 3	7	59.1	1.8	**25.2**
Grown for two years:										
62 Early Genesee Giant	Ba.	W.	medium	61.3	1.4	36.4	8	61.1	2.7	**46.7**
63 Siberian	Ba.	R.	very good	61.8	1.8	36 6	18	62.4	3.0	**43.1**
64 Early Ripe	Ba.	R.	medium	61.9	1.3	27.7	21	61.7	2.8	**41.5**
65 Tasmania Red	Be.	R.	good	61.9	1.5	35.3	45	61.9	3.0	**41.2**
66 Jones' Square Head	Ba.	W.	very good	57.6	1.6	30 9	.....	59.0	2.4	**39 6**
67 Pride of Genesee	Be.	R.	medium	62.1	1.3	27.7	20	61.3	2 6	**39.6**
68 Turkish Red	Be.	R.	very good	62.3	1.5	31.7	23	62.3	2.6	**39.2**
69 Egyptian Amber	Be.	R.	good	61.9	1.3	32.1	33	61.1	2.9	**38.1**
70 McPherson	Ba.	R.	very good	61.1	1.5	28.3	15	61.7	2.7	**36.7**
71 Arnold's Hybrid	Ba.	R.	good	60 0	1.2	25.1	11	61.1	2.6	**36.7**
72 Imperial Amber	Be.	R.	medium	59 9	1.5	29 2	45	59.0	3.2	**36.3**
73 Poole	Ba.	R.	medium	59.6	.8	21.1	21	60.6	2.4	**35.9**
74 Zimmerman	Ba.	R.	medium	60.8	1.2	26.7	1	61.9	2.1	**35.5**
75 Geneva	Be.	R.	medium	63.2	1.2	30.0	34	62.4	2.7	**35.1**
76 Red May	Ba.	R.	medium	62.2	.8	20.4	10	62.4	2.4	**34.4**
77 Emporium	Ba.	R.	good	59.1	1.2	27.4	23	58.6	2.6	**34.3**
78 New Columbia	Ba.	R.	medium	58.8	.6	16.3	8	58.5	2.3	**33.2**
79 Simcoe Red	Be.	R.	very good	60.6	1.3	27.7	30	58.8	2.8	**33.0**
80 Tuscan Island	Be.	R.	medium	59.5	.9	20.3	33	59.7	2.4	**32.6**
81 Kentucky Giant	Be.	R.	medium	59.3	.8	18.4	35	58 9	2.4	**31.8**
82 Rudy	Be.	R.	poor	61.4	.5	13.9	39	60 5	2.2	**31.4**
83 Penquit's Velvet Chaff	Be.	R.	medium	61.9	.9	21.6	1	62 0	2.8	**31.0**
84 Bissell	Be.	R.	medium	61.2	.8	20.3	36	61.0	2.4	**30.2**
85 Andrew's No. 4	Be.	R.	medium	60.6	.7	17.1	24	60.3	2 6	**29.7**
86 Golden Tankard	Be.	R.	very good	60.9	1.1	25.9	46	60.2	3.2	**28.7**
87 Currell	Ba.	R.	medium	60.9	.8	20 2	20	61 2	2.5	**28.7**
88 Currell's Prolific	Ba.	R.	medium	60.6	.8	19.6	25	61.1	2.6	**28.2**
89 Hindostan	Be.	R.	medium	60.4	.5	11.7	23	61 0	2.3	**28.2**
90 Bullard's Velvet Chaff	Ba.	R.	very poor	58.6	.2	3.5	.....	60.8	1.3	**17.6**
Grown for one year:										
91 Michigan Amber	Be.	R.	very good	61.8	1.4	35.5	....	61.8	1.4	**35.5**
92 Giant Square Head	Be.	W.	good	60.1	1.4	33.4	.....	60 1	1.4	**33.4**
93 White Bearded	Be.	W.	good	58.9	1 3	31.8	.....	58.9	1.3	**31.8**
94 Silver Star	Ba.	W.	good	61.7	1.3	27.8	.....	61.7	1.3	**27.8**
95 Amherst Isle	Be.	R.	medium	59.9	1.1	25.0	3	59.9	1.1	**25 0**
96 German Emperor	Ba.	R.	good	59.8	1.2	24.2	.....	59.8	1.2	**24.2**
97 Hunter's Wheat	Be.	R.	medium	60.9	1.0	22.4	....	60.9	1.0	**22.4**
98 Pride of Illinois	Ba.	R.	good	60.2	1.0	21.5	.....	60.2	1.0	**21.5**
99 Long Amber	Ba	W.	medium	59 0	.8	13.8	.....	59.0	.8	**18.8**
100 Kalina	Be.	R.	good	60 1	.8	17.6	.....	60.1	.8	**17.6**
101 Mealy	Ba.	R.	medium	60 4	.6	12.1	....	60.4	.6	**12.1**
102 Nonpareil	Be.	W.	very poor	59.2	.4	7.4	.....	59.2	.4	**7.4**

The varieties given in the preceding table were obtained from Ontario, the United States, Germany, France and Russia. Thirty kinds were imported from Europe by the College in the spring of 1889, and have been carefully tested in our plots; but, owing to lack of hardiness, twenty of the number have been discarded. The remaining ten have been grown for the past six years in succession, but are among the poorest yielders reported upon in this bulletin. All our leading varieties of winter wheat, therefore, have been obtained from either Canada or the United States. Mr. A. N. Jones, of Newark, N Y., has been instrumental in introducing some very excellent varieties, among which the Early Red Clawson, American Bronze, Jones' Winter Fife and Early Genesee Giant are prominent. It is, however, to Mr. Robert Dawson of Paris, Ont., that we must give credit for Dawson's Golden Chaff, a variety which has made the highest average record of all the varieties tested at this station during the past four years.

Bald and Bearded Varieties. Of the one hundred and two varieties grown in 1895, fifty-six possessed bald heads and forty-six bearded heads. During each of the six years past, the bearded varieties gave a heavier weight per measured bushel than the bald sorts, but in yield of grain per acre the bald wheats came first in four out of the six years. In making up this comparison, varieties possessing very short beards were classed as bald wheats.

The following table gives the comparative results of the bald and the bearded varieties for 1895, and for the average of six years:

Periods.	Average results of bald varieties.			Average results of bearded varieties.		
	Weight per measured bushel.	Yield per acre.		Weight per measured bushel.	Yield per acre.	
		Straw.	Grain.		Straw.	Grain.
	lbs.	tons.	bush.	lbs.	tons.	bush.
1895	60.0	1.2	27.1	60.8	1.1	25.1
Average of six years, 1890-1895	60.1	2.5	38.8	61.3	2.5	37.1

Color of Grain. Twenty-nine varieties of white wheat and seventy-three varieties of red wheat were tested during the past year. In five of the last six years, the red wheats gave a heavier weight of grain per measured bushel than the white varieties, but in 1890 the white wheats gave slightly the heaviest grain. The amber, bronze and golden wheats have all been classed as red.

The following table gives the comparative results of the white and the red wheats for 1895, and for the average of six years:

Periods.	Average results of white wheat.			Average results of red wheats.		
	Weight per measured bushel.	Yield per acre.		Weight per measured bushel.	Yield per acre.	
		Straw.	Grain.		Straw.	rain.
	lbs.	tons.	bush.	lbs.	tons.	bush.
1895	59.9	1.3	27.5	60.6	1.1	25.6
Average of six years, 1890-1895	60.0	2.5	39.3	60.9	2.5	37.7

It will be seen from the above tables that the amount of straw in the average of six years' trials was the same from bald, bearded, white and red varieties of winter wheat. The bearded kinds produced the heaviest weighing grain and the white varieties gave the largest average yield of grain per acre.

Experiments in the Methods of Winter Wheat Growing.

The following concise reports are made upon different winter wheat experiments conducted in the same portion of the experimental grounds that was used for the variety tests. Some of these experiments extend over a period of two and some over a period of three years.

Different Dates of Seeding. During each of the past three years two or more varieties of winter wheat have been sown at three different times in the month of September. The following table gives the average yields for the three years occupied by this experiment :

Dates of seeding.	Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.
	lbs.	tons	bush.
September 2-3	57.8	2.4	31.8
" 7-9	58.0	2.5	31.3
" 17-19	56.2	1.6	25.2

It will be seen that the seedings of the 7th and 9th of September produced results about equal to those from the seedings of the 2nd and 3rd. Such is not the case, however, when the results of the last dates are compared with those of either the first or the second, as they are considerably lower in every particular.

Methods of Seeding. An experiment in sowing winter wheat broadcast and with a grain drill has been conducted in duplicate during the past two years. The results show the yields of both straw and grain to be practically the same from sowing similar quantities of grain by the two methods ; but, in weight of grain per measured bushel, the product of the drilled grain has been heavier than that sown broadcast in each of the four tests, the average difference being two-fifths of a pound.

Different Quantities of Seed per Acre. In 1894 and in 1895, two varieties of winter wheat were sown broadcast on small plots, at the rates of one, one and one-half and two bushels per acre. The largest yields of both grain and straw were obtained from the thickest seeding and the smallest yields from the thinnest seeding during each of the two years. The weight of grain per measured bushel was nearly the same from all the plots. To determine the proper quantity of winter wheat to sow per acre, in order to obtain the best results upon different farms, the individual wheat growers can best experiment for themselves, as so much depends upon the fertility of the soil and other conditions.

The Yield and Quality of Winter Wheat as affected by cutting at different stages of maturity. Five plots each of the Dawson's Golden Chaff and the Early Genesee Giant varieties of winter wheat, were sown upon the same date in 1893 and again in 1894. These two varieties reached the stage of maturity at which wheat is usually cut in Ontario, on the 19th of July, in 1894, and on the 18th of July in 1895. The two wheats were cut at five different periods during the two years, as follows: July 4th, July 11th, July 18th and 19th, July 26th and August 2nd. During both years, the greatest yield of straw was obtained from cutting on July 4th, and the heaviest weight of grain per measured bushel from cutting on July 18th and 19th. The yield of grain per acre was largest from the last cutting in 1894 and from the second last cutting in 1895. The lowest results in yield of grain per acre and in weight of grain per measured bushel, were obtained from the cutting of each variety on July 4th of each year.

Value of Grain for Seed as affected by cutting at different stages of maturity. Dawson's Golden Chaff and the Early Genesee Giant varieties of winter wheat were both sown on the same day in 1893, and a plot of each was cut on July 4th, 11th, 19th and 25th, and August 2nd, 1894. The first cutting took place about two weeks before, and

the last cutting about two weeks after, that stage of ripeness at which winter wheat is usually cut. A quantity of seed of each variety was taken from each of the five different cuttings, and these ten equal amounts of grain were sown upon a similar number of uniform plots on Sept. 7th, 1894. In 1895, the plots were all harvested at one time, and, in the case of each variety, it was found that the largest yield of grain per acre was produced by the seed of the last cutting of the previous year, and the plumpest sample was produced from the seed of the second and third cuttings.

Selection of Seed. Several experiments are being conducted in the selection of grain for seed ; but it will be some time before the most valuable results can be obtained from this line of experimental work.

Co-operative Experiments with Winter Wheat.

Fifteen varieties of winter wheat, which have been the most successful among all the varieties tested on our experimental grounds, have been distributed over Ontario within the past three years. These have been sent out in sets of five varieties each. Five thousand and eight hundred packages of winter wheat alone have been distributed during the three years, and comparative tests have been made upon more than eleven hundred Ontario farms. This system of co-operative experimental work was established by the ex-students of the Agricultural College ; but, through repeated requests from other farmers, the invitation is extended to all interested persons to join in the work. The results have, on the whole, been very gratifying and the numerous experimenters have become much interested in the different experiments undertaken. For detailed reports of these co-operative experiments, the reader is referred to the Annual Report of the Agricultural Experimental Union which is printed along with the report of the Agricultural College. From among ten conclusions given in the report of last year regarding these co-operative experiments with winter wheat for 1894, the following two conclusions are quoted as being of interest in connection with the results given in this bulletin.

1. "Dawson's Golden Chaff gave the largest yield of grain per acre among the nine varieties tested over Ontario in 1894, as well as among the eleven varieties tested in 1893."

2. "Dawson's Golden Chaff was decidedly the most popular variety with the experimenters in both 1894 and 1893."

All the varieties of winter wheat distributed over Ontario each year are grown in duplicate in our Experimental Department on exactly the same sized plots that are used throughout the Province.

Conclusions.

1. The average results of winter wheat growing on the experimental plots for six years in succession are as follows: Weight of grain per measured bushel, 60.6 lbs. ; yield of straw per acre, 2.5 tons; and yield of grain per acre 38.2 bushels.

2. Dawson's Golden Chaff gave the largest average yield of grain per acre among fifty-three varieties of winter wheat grown at the Ontario Agricultural College for four years in succession ; also among nine leading varieties tested over Ontario in 1894, and among eleven leading varieties tested over Ontario in 1893.

3. The varieties which possessed the stiffest straw among fifty-three kinds of winter wheat grown for four years in succession, were Dawson's Golden Chaff, American Bronze, Fultz, Velvet Chaff, and Red Russian.

4. The varieties of winter wheat which proved the hardiest in 1895, among one hundred and two varieties tested, were Dawson's Golden Chaff, Stewart's Champion, Siberian, Jones' Square Head, Turkish Red, and McPherson.

5. When winter wheat was sown later than September 9th, the crop was much poorer than when the seeding took place on or before that date.

6. In 1895, the varieties of winter wheat possessing bald heads and white grain gave an average of 4.3 bushels of grain per acre more than the varieties possessing bearded heads and red grain; but, in average weight per measured bushel, the latter surpassed the former by 1.3 pounds.

Distribution of Seed for Testing Purposes.

In the following table will be found two sets of winter wheat varieties, which will be sent free, by mail, in half pound lots of each variety to farmers applying for them, who will carefully test the five kinds in the set which they choose, and will report the results after harvest next year. The seed will be sent out in the order in which the applications are received, as long as the supply lasts.

Two sets of winter wheat for Co-operative Tests.

Set 1.	Set 2.
Dawson's Golden Chaff.	Dawson's Golden Chaff.
Early Red Clawson.	Early Genesee Giant.
Jones' Winter Fife.	Pride of Genesee.
Surprise.	Bulgarian.
American Bronze.	Jones' Square Head.

Each person wishing one of these sets should write to the Experimentalist, Agricultural College, Guelph, *mentioning which set he desires,* and the grain, with instructions for testing and blank forms on which to report, will be forwarded free of cost to his address, until the supply of grain for distribution is exhausted.

Seed Wheat.

The Dawson's Golden Chaff and the Early Genesee Giant varieties of winter wheat were grown in the farm department in 1895. Limited quantities of these were offered for sale by the Farm Superintendent at $1.25 per bushel for the former and $1.50 per bushel for the latter.

Oats—Comparative Test of 90 Varieties.

When we realize that there were 2,373,309 acres devoted to oats in Ontario during 1895, we have some conception of the importance of this class of grain. There were nearly as many acres devoted to the growing of oats in this Province in 1895, as there were devoted to the growing of all other kinds of grain. The demand for new and promising varieties of oats is greater than that for any other class of spring grain. This is made manifest by the large number of applications which we receive annually for samples of oats for testing purposes. We are very pleased indeed that we have been successful in obtaining some excellent varieties of oats from foreign countries. These new varieties have not only proven themselves to be well suited to our land at the Agricultural College, but also for various soils throughout the Province. During the past four years the leading varieties of oats have been successfully tested on about five hundred Ontario farms.

In 1895, ninety varieties of oats were tested in the experimental department. The plots used for the oats were of exactly the same size, each plot being ten links wide by one hundred links long, thus making one-hundredth of an acre. The grain was sown broadcast at the rate of seventy-five pounds per acre, and the seeding of the varieties took place on the 25th of April The land on which the oats were grown was an average clay loam, which had been manured at the rate of twenty tons of farmyard manure per acre in the spring of 1894, after which it produced a crop of potatoes. The yields per acre are estimated from the actual yields of the plots.

OATS—COMPARATIVE TEST OF 90 VARIETIES.

Varieties.	Seed obtained from—	Color of grain.	Character of head.	Results for 1895.					Average results f number of years grown on plots.		
				Date of maturity.	Weight per measured bushel.	Straw per acre.	Grain per acre.		Weight per measured bushel.	Straw per acre.	Grain per acre.
							Small grain.	Large grain.			
Grown for seven years:					lbs.	tons	bus.	bus.	bus.	tons.	bus.
1 Joanette Black	France	B	S	Aug. 14	37.00	3 00	26.00	90.69	36 01	2.73	**87.65**
2 Siberian (Russia)	Russia	W	S	" 14	36.08	3.27	47.06	64.71	35.76	2.71	**82.89**
3 Waterloo	Germany	W	S	" 14	38.88	3.36	30.15	108.82	32.03	2.65	**81.68**
4 Probsteier	"	W	S	" 12	39.00	2.98	37.50	90.44	33.33	2.51	**81.24**
5 Danebrog	"	W	S	" 13	39.24	3.21	30 88	99.26	33 63	2.52	**81.09**
6 Bavarian	Ontario	W	S	" 14	38.12	3.50	41.91	97.07	31.85	2 81	**79.71**
7 Poland White	France	W	S	" 10	40.12	3.42	41.18	75.74	37.89	2.55	**79.19**
8 Improved Besthorne	Germany	Y	S	" 10	39.12	2.48	28.68	77.21	33.63	2.17	**78.46**
9 Georgian	"	W	S	" 15	35 88	3.44	41.18	83.82	32.96	2 80	**76.30**
10 Yellow Gigantic	France	Y	M	" 19	31 36	3.43	48.53	88.24	29 55	2.76	**75.57**
11 Egyptian	Ontario	W	M	" 14	39.52	3.33	32.35	83 09	35.32	2.82	**75.15**
12 Black Poland	Scotland	B	M	" 14	35.24	3.54	41.91	80 88	30 23	2.93	**72.81**
13 Black Champion	Ontario	B	M	" 14	35.00	3.50	34.56	85.29	29.94	2.62	**71.43**
14 Rosedale	"	W	M	" 12	40 00	3.33	30.88	75.74	34.46	2.94	**70.08**
15 Black Tartarian	Scotland	B	M	" 14	35.00	3.06	41.91	83.82	31.99	2.85	**69.69**
16 Victoria White	"	W	S	" 10	43.36	3.17	27.94	72.06	39.61	2.68	**68.49**
Grown for five years:											
17 Vick's American Banner	United States	W	S	Aug. 13	37.76	3.29	36.03	101.47	32.34	2.40	**88.28**
18 White Schonen	Ontario	W	S	" 13	38.64	3.21	38.24	91.91	33 00	2.40	**87.85**
19 Magnet	"	W	S	" 15	34 00	4.44	46.32	86.76	31.42	2.82	**86.13**
20 Wide Awake	"	W	S	" 14	39.24	3.58	26.47	102 94	34.26	2.48	**85.68**
21 Danish	New Zealand	W	S	" 14	35.00	3.61	38.24	97.07	23.43	2.41	**84.47**
22 Golden Giant	Ontario	Y	M	" 24	32.00	4.10	45.59	86.76	29.02	2.63	**83.41**
23 White Mane	"	W	S	" 14	34.52	4.79	43.38	80.88	32 37	2 85	**82.98**
24 Holstein Prolific	"	W	S	" 14	36.52	3.38	36.03	90 44	32 62	2.29	**82.52**
25 Giant Swedish	"	Y	M	" 22	32.52	4.18	47.79	91.91	29.49	2.71	**81.26**
26 Early Calder	"	W	S	" 14	34.24	3.50	38.24	70 59	32 76	2.52	**77.80**
27 Giant Yellow	United States	Y	S	" 14	41.24	3.51	25 74	73.53	35.22	2.37	**73.56**
28 Early Gothland	Ontario	W	M	" 14	39.12	3 01	30 88	69.85	35.94	2.45	**71.89**
29 Clydesdale	"	W	S	" 9	43.36	2.73	22.79	81.62	38.30	2.64	**70.51**
30 White Belgian	"	W	S	" 9	44.12	2.96	43 38	55.15	38.02	2.44	**69.88**
31 Black Mane	"	B	M	" 13	35.00	3.16	38 97	70.59	30.31	2 53	**68.84**
32 White Swiss	United States	W	M	" 12	39.88	3 23	39.71	57.35	35.78	2.43	**68.64**
33 Japan	"	W	S	" 8	44.00	2.67	33 09	71.32	39.29	2.47	**67.87**
34 Carter's Early Black	England	B	M	" 14	35.12	3.29	44.85	72.79	30.27	.....	**67.38**
35 Early Archangel	Ontario	W	S	" 9	41.76	2.84	36 03	68.38	33.40	2.32	**67.33**
36 New Rosedale White	"	W	M	" 12	39.00	3.25	27.21	72.06	36.10	2.30	**65.10**
37 Carter's Royal Cluster	England	W	S	" 9	44.00	2.89	31 62	70.59	39 27	2.31	**64.40**
38 Victoria Prize White	"	W	S	" 6	45.44	2.88	26.47	69.12	40.74	2 13	**61.32**
39 Canadian Triumph	Ontario	W	S	" 9	44.52	2.70	23.53	57 35	40.34	2.17	**61.23**
40 Black Glen Rothern	"	B	S	" 26	35.92	4.26	38.97	63.24	32.21	2.96	**60.16**
41 Rennie's Prize White	"	W	S	" 7	45.24	2.92	22.06	70.59	40.27	2.09	**59.98**
Grown for four years:											
42 Joanette (new French seed)	Ontario	B	S	Aug. 15	37.12	3.23	24.51	90 93	34.88	2 61	**79.82**
43 Baltic White	United States	W	S	" 13	40.76	2.82	27.21	82.36	36.22	2.49	**74.36**
44 Abyssinian	Ontario	W	M	" 12	40.64	3.00	23.53	68.38	36.76	2.71	**69.55**
45 American Beauty	"	W	M	" 12	39.64	2.62	27.94	61.03	26.23	2.49	**66.75**
46 Thousand Fold	United States	W	M	" 12	39.52	2.74	27.21	61.76	35.56	2.49	**63.49**
47 Badger Queen	"	W	S	" 5	44.36	2.31	22.06	56.62	39.62	2.51	**60.33**
48 Wilson's White Prolific	"	W	M	" 12	39.12	2.58	21.32	51.47	32.84	2.21	**60.05**
49 New Wonderful	Ontario	W	S	" 5	45.00	2.44	26.47	54 41	39.38	2.31	**59.09**

OATS, COMPARATIVE TEST OF 90 VARIETIES.—*Continued.*

Varieties.	Seed obtained from—	Color of grain.	Character of head.	Results for 1895.					Average results for number of years grown on plots.		
				Date of maturity.	Weight per measured bushel.	Straw per acre.	Grain per acre.		Weight per measured bushel.	Straw per acre.	Grain per acre
							mall grain.	Large grain.			
					lbs.	tons.	bus.	bus.	lbs.	tons.	bus.
Grown for three years:											
50 Green Mountain	United States	W	S	Aug. 12	38.24	2.70	30.15	78.68	33.11	2.19	77.35
51 New American	"	W	S	" 13	38.52	2.89	32.35	83.82	33.12	2.35	76.98
52 High Bred	"	W	S	" 8	41.24	2.90	32 35	72.06	38.56	.....	76.89
53 Lincoln	"	W	S	" 12	39 36	2.71	25 74	77.94	35.35	2.36	76 68
54 Improved American .	"	W	S	" 13	39.12	2.77	29.41	78.68	33 79	2.29	74.96
55 Black Beauty.....	"	B	S	" 8	35.52	2 53	36.76	57.35	33.71	2.39	74.77
56 New Zealand.....	"	W	S	" 13	39.52	2 49	25.00	73.53	32.93	2 22	73.26
57 South Carolina Black	"	B	S	" 15	38.52	2.88	33.09	64.71	34.76	2.59	68.33
58 Royal Prize Cluster..	England	W	S	" 7	45.24	2.84	30.15	66.18	40.14	2.40	67.13
59 Pringle's No. 6	United States	W	M	" 26	35.00	4 10	28.24	70.59	32.96	2.81	67.30
60 Rust Proof	"	W	S	" 8	43.24	2.80	23.53	73.53	35.68	2.43	67.14
61 Excelsior..	"	W	S	" 12	37.12	3.30	33.09	64.71	32.73	2.47	66 15
62 Jarman's White Monarch.....	England . ..	W	S	" 7	42.36	2.85	28.68	65.44	38.23	2 36	63.83
63 Challenge	Ontario	W	S	" 13	37.24	3.17	20.59	58.09	38.01	2.66	63.61
64 North Star.....	United States	W	S	" 9	42.24	3.05	25.74	68.38	38.49	2.40	61.22
65 Jarman's Black Defiance	England	B	M	" 24	29.52	4.11	28.68	52.94	29.51	2.60	59.32
66 Texas Rust Proof....	United States	D	S	.....	32.52	3.11	34.56	61.76	30.75	2.46	55.55
Grown for two years:											
67 Peerless	Ontario.....	W	S	Aug. 13	37.76	3.40	39.71	98.53	34.16	3.15	101.39
68 Surprise	United States	W	S	" 14	37.64	3.34	33.82	85 29	34.94	3.30	96.15
69 Negro Wonder	"	B	S	" 9	34.76	3.23	48.53	66.18	34.26	2.89	92.65
70 Bonanza King	"	W	S	" 12	38.88	2.93	38.97	88.97	36.04	2 43	92.65
71 Bolton	"	W	S	" 10	37.88	3.12	39.71	81 62	34.88	2 59	90.17
72 Hull	Ontario.....	W	M	" 19	34.76	3.35	54.41	70.59	33.38	2 91	85.86
73 Pride of America	United States	W	M	" 10	38.24	3.16	40.44	71.32	37.34	2.95	85 66
74 Improved White Russian	"	W	M	" 19	35.64	2.99	48.53	72.06	34.00	3 04	84 28
75 Australian Square Head	"	Y	M	" 16	34 00	3.17	47.06	77.21	32.28	2.82	83.55
76 White Swede.... ...	"	W	M	" 19	35.76	3.21	50.00	70 59	34.78	2.98	79.69
77 Mammoth Cluster ...	"	B	M	" 14	35.36	3 23	40.44	70.59	31.43	2.63	72.43
78 Red Tamworth.....	Ontario.....	D	S	" 19	33.76	2.74	33.82	68.38	32 38	2.27	68 94
79 Lousinee	"	W	S	" 12	35.24	1.40	19.12	36.03	34.58	1.50	56.90
80 Salzer's Great Northern	United States	W	S	" 12	37.00	.93	13.24	27.94	34.76	1.45	49 64
Grown for one year:											
81 Nameless Beauty	United States	W	S	Aug. 10	36.76	2.92	44.85	77.21	36 76	2.92	122.06
82 New Siberian	"	W	S	" 12	36.12	3.39	48.89	71.33	36.12	3.39	120.22
83 New Electric.....	Ontario.....	W	S	" 10	37.64	2.72	36.76	78.68	37.64	2.72	115.44
84 White Bedford	United States	W	S	" 10	36 24	3.02	41.18	71.32	26 24	3 02	112.50
85 Black Diamond.....	Ontario	B	S	" 12	36.52	2.79	44.85	67.65	36.52	2.79	112.50
86 Mexican Gray	United States	mix	S	" 8	35.24	2.86	41.91	63.24	35.24	2.86	105.15
87 White Superior Scotch	"	W	....	" 3	43.36	2.63	29.41	68 38	43.36	2.63	97.79
88 Danbings	"	W	S	July 27	37.76	1.83	41.18	58.88	37.76	1.83	97.06
89 Royal Doncaster	"	W	S	Aug. 19	37.88	3.10	34.56	58.09	37.88	3.10	92.65
90 Prolific Side Oat	"	W	M	" 10	38.52	2.85	27.94	61.76	38.52	2.85	89.70

The oat crop during the year 1895 was excellent; the straw was long, the heads were well filled, and the grain was plump. There was but little trouble with the rust; but some of the varieties contained a considerable amount of smut. The heavy storm

previous to the time of harvest caused a large number of the varieties to be very badly lodged. The average length of the straw varied from thirty-four and a half to fifty-seven inches.

Within the past seven years one hundred and fifty-seven varieties of oats have been tested in the experimental department. Of this number seventy-nine were grown for five years in succession previous to the spring of 1894, at which time seventeen of the best varieties were selected for further tests, and sixty-two varieties were discarded. When it is mentioned that sixty-two varieties were discarded, it should be clearly understood that those sixty-two were not all poor varieties ; but they were not among the leaders, and it is the leading varieties that we are after. Information in regard to the comparative standing of all the varieties is very important, as it gives farmers a chance to compare varieties with which they are not familiar, with those of which they have had a certain amount of experience. Besides the sixty-two varieties which were discarded in the spring of 1894, there were also three varieties discarded in the spring of the present year.

Leading Varieties of Oats.

Among the seventy-nine varieties of oats which were tested for the first time in our experimental department in 1889, are those from a large number of foreign countries which have a climate somewhat similar to that of Ontario. The countries which have furnished us with some of the best varieties are France, Russia and Germany. All the varieties that could be obtained throughout Ontario were included in the seventy-nine previously mentioned.

Joanette Black. Among all the varieties that we have grown for seven years in succession in the experimental department, the Joanette Black has given the largest average yield of grain per acre. This variety was imported from France six years ago last spring. It possesses a very short straw and a black grain, which is exceedingly thin hulled. It is one of the greatest oats to stool that has come under our observation at the Agricultural College. The grain ripens medium early, and if allowed to get very ripe, is apt to shell considerably. As the grain possesses a very thin hull, there is usually a considerable amount hulled during the process of threshing. The Joanette variety seems well suited to strong, rich soils, which usually produce a large amount of straw, but, upon those lands which generally produce short straw, the Joanette oats may be considered a failure. It is, therefore, a special oat, being exceedingly well adapted to some soils in Ontarto.

It will be observed in the foregoing table that the Joanette oats have given the largest average yield of grain per acre, among all the varieties grown for seven years in succession at the Agricultural College. Beside giving an excellent yield per acre, it has also produced a grain which has given an average weight of a little over thirty-six pounds to the measured bushel. When we remember that this oat also possesses an exceedingly thin hull, we can see plainly that there is a large amount of grain of a very excellent quality. Although the straw is generally quite short, still, as it stools so much, the average amount of straw for seven years is about two and three-quarter tons per acre, which is as much as that of many of the other varieties.

In the co-operative experiments over Ontario, the Joanette has occupied third place in yield of grain per acre, among six leading varieties distributed over Ontario during each of the past four years in succession. In 1895 it produced 54.9 bushels per acre in the average results of the tests successfully conducted upon seventy-eight Ontario farms. The average yield of straw was 1.4 tons per acre. The Joanette and Oderbrucker stood second in popularity among the six varieties tested, as reported by the different experimenters.

Siberian. Previous to the spring of 1894, sixty-one varieties of white oats were grown in the experimental department for five years in succession, and the leading varieties among these sixty-one have now been grown for seven years, with the Siberian at the head of the list in point of yield per acre. This very excellent oat was imported by our College from Russia in the spring of 1889. It possesses a long straw, spreading head,

white grain and thin hull. The crop usually stands up well, and is generally but little affected by rust. In 1895, there was an average of 14.6 heads per plant, which was one of the best varieties in this respect. The Joanette, however, produced an average of over twenty heads per plant. The grain of the Siberian has weighed on an average thirty-five and three-quarter pounds per measured bushel; and, as this is also a thin hulled variety, the grain furnishes a large amount of food of excellent quality. A deputation from the Oatmeal Millers' Association selected the Siberian as one of the best among one hundred and eight varieties submitted for their inspection.

For four years in succession the Siberian has headed the list in yield of grain per acre in the co-operative experiments throughout Ontario. In 1892, it gave the largest yield of grain per acre in the tests of the six varieties grown on one hundred and twenty-five Ontario farms; in 1893, the highest in the average of the tests on one hundred and five farms; in 1894, the highest in the average tests on one hundred and twenty-one farms; and in 1895, the highest avarage yield on seventy-eight different farms. This makes for the Siberian a very high record. If we were asked to name the best all-round variety of oats in Ontario at the present time, we would point out the Siberian as the one which had given the highest all-round record in our experimental work, both here and over Ontario.

Waterloo. The Waterloo variety of oats, which was obtained from Germany, has proven to be a very good yielder, giving an average of eighty-one and two-third bushels per acre in seven years' experiments. Perhaps its weakest point is the light weight of the grain, as during the average of seven years, the weight per measured bushel is only a little over thirty-two pounds. It is four pounds per measured bushel less than that of the Joanette, and three and three-quarter pounds per measured bushel less than the Siberian. The straw grew to an average height of about fifty inches during the past season. The average number of heads per plant during 1895 was twelve, ranging from six to seventeen.

Bavarian. Among fifteen varieties of Ontario oats which helped to make up the seventy-nine varieties which were grown between 1879 and 1894, the Bavarian stands at the head of the list in yield per acre of the Ontario varieties. It has now been grown in this Province for about twelve years, and previous to its introduction here it had been grown in the State of New York for about five years after its importation from Bavaria. It is a white oat with spreading head, and possesses a good average straw and a grain of good quality. In the co-operative experiments over Ontario in 1895, it occupied second place among six varieties tested on seventy-eight different farms. In 1894, however, it occupied fourth place in average yield per acre among six varieties sent out during that year, and successfully tested on 121 Ontario farms. In weight per measured bushel, it has given an average of a little less than thirty-two pounds in the average of seven years' tests at the Agricultural College. This is one of the weakest features of this oat. The Bavarian was imported about the same time as the Joanette and the Siberian.

Egyptian. Of all Ontario oats which have been grown for seven years, the Egyptian has given the best results among those which are pretty generally known throughout the Province. This variety, however, gave an average, during the seven years, of 12.5 bushels per acre less than the Joanette, and 7.7 bushels per acre less than the Siberian. In average weight of grain per measured bushel, the Joanette has surpassed Egyptian by about two-thirds of a pound, and the Siberian has surpassed it by about one-third of a pound. In every one hundred pounds of Egyptian oats, there are about forty pounds of hull; in the same quantity of Joanette oats, twenty-six pounds of hull, and in the Siberian, about thirty pounds of hull.

Poland White The Poland White variety of oats was imported from France, and occupies seventh place in point of yield of grain among all the varieties grown for seven years. It is the best yielder of all the early varieties. The weight per measured bushel is nearly two pounds more than Joanette in the average of the seven years' trials. In the co-operative experiments over Ontario for the last three years, it has occupied an intermediate place, but during 1895 it came at the bottom of the list in yield of grain per acre among the six varieties distributed.

Vick's American Banner. A quantity of Vick's American Banner oats were obtained from the United States five years ago, and has been grown in our trial grounds each year since that date. During the five years which it has been grown, it has given an average of 88.28 bushels per acre. The Joanette, during the same length of time, has given an average of 94.03 bushels per acre, and the Siberian 92.37 bushels per acre. The Joanette gave an average of five and three-quarter bushels per acre more than Vick's American Banner, and the Siberian an average of 4.01 bushels per acre more than the Banner. Vick's American Banner gave about four pounds per measured bushel less than the Joanette Black, and upwards of three pounds per measured bushel less than Siberian in the results of the experiments for the number of years that these varieties have been tested at the Agricultural College.

Beans—Comparative Test of 13 Varieties.

During the year 1895, thirty-two plots were devoted to the growing of beans. The experiment was purely with varieties planted at two different dates. One set of sixteen varieties was sown on the 3rd of June, and a duplicate was sown on the 24th of June. There were five rows of each variety sown in each experiment. The rows were three rods, seven and a third feet in length, and were three links, or nearly twenty-five inches, apart. The land on which the beans were planted received a coating of farmyard manure at the rate of twenty tons per acre in the spring of 1894, and produced a crop of green fodder the same year. The yields per acre were estimated from the actual results of the plots.

Varieties.	Weight per measured bushel.			Yield of grain per acre.			
	1894.	1895.	Average.	1893.	1894.	1895.	Average.
	lbs.	lbs.	lbs.	bus.	bus.	bus.	bus.
California Pea	62.38	64.94	63.66	28.8	16.60	10.57	18.66
Small White Field	65 06	62.50	63.78	24.6	14.17	15 89	18.22
Prolific Dwarf Tree	64.81	64.13	64.47	27.3	12.64	14.40	18.11
Boston Pea	64.50	64.19	64.35	22.3	15.21	16.48	18.00
Medium or Navy	60 38	65.32	62.85	17.7	19.87	12.70	16.76
Yellow Soy	59.13	56.33	57.73	20.4	15.56	12.30	16.09
Yellow-Eyed or Boston Favorite	59.50	61.50	60.50	17.3	4.48	11.00	10.93
Giant Dwarf Wax	52.44	51.66	52.05	15.8	9.10	6.81	10.57
Marrowfat	62.88	63.63	63 26	5.9	7.78	16 79	10.16
Edamaine	59.00	57.75	58 38	7.6	6.94	7.79	7 44
Royal Dwarf Kidney	60.06	59 63	59.85	.....	17.71	9.94	13.83
Yosemite Mammoth Dwarf Wax	58.19	.....	.....	7.2	6.26	.....	6.73
Snowflake	.....	63.13	.....	.....	.....	13.35	13.35

Besides the varieties mentioned in the foregoing table two varieties of horse-beans and one variety of cow-peas were also grown, but they did not reach the stage of maturity sufficient to thrash. It will be observed that the Marrowfat variety of beans gave the largest yield of grain per acre, the Boston Pea bean second largest, and the Small White Field bean the third largest yield per acre in the results for 1895. During the average of three years, however, the California Pea heads the list in yield of grain per acre. The highest average weight of grain per measured bushel was given by Prolific Dwarf Tree and Boston Pea varieties of beans, and the lowest average weight per measured bushel was produced by the Giant Dwarf Wax variety.

Spring Grain—Influence from Stirring the Surface Soil during the Growing Season.

In the spring of 1895, nine varieties of spring grain were grown on plots one hundred and eighty links long by one hundred links wide. Each of these plots was again divided into four equal-sized sections, so that in all there were thirty-six plots. On eighteen of these we used the Zephaniah Breed weeder weekly during a term of about six weeks. When we started to use the weeder, the grain was about two inches in height; and when we quit it was approaching the condition of heading. This weeder is made something after the style of an ordinary hay rake. The teeth scratch the ground and thus stir the surface soil. The results of the use of this implement during the past year show but very little influence from the use of the weeder. The raked land produced thirty-four pounds of grain per acre more than the unraked. No definite conclusions can, therefore, be drawn from this experiment until it is repeated for a number of years.

Beans—Different Dates of Seeding.

The sixteen varieties of beans which have been reported upon were planted at two different dates, namely, on June 3rd and June 24th. The size of the plots, etc., were described under the heading of varieties. As we have conducted this experiment for only one year, the results are not nearly so valuable as they would be if the experiment had been made for a number of years. It may, however, be continued in future.

Dates of seeding.	Weight per measured bushel.	Yield of grain per acre.
	lbs.	bus.
June 3rd	62.46	11.78
June 24th	61.73	4.31

It will be observed that the seeding of June 3rd gave nearly three times as large a yield per acre as the seeding on June 24th. The weight per measured bushel from the beans of the first seeding was about three-quarters of a pound more than that of the last date of seeding. It will be remembered that for each of these dates the average of all the varieties tested is herein given. The germination of the beans was about equal in the two seedings.

Buckwheat—Comparative Test of 3 Varieties.

On June 10th, 1895, three varieties of buckwheat were sown on the experimental plots at the Agricultural College. This was the second year that these varieties had been grown for experimental purposes. The plots were one hundred and sixtieth of an acre in size, and the land produced a crop of grain in 1894. The buckwheat was sown broadcast at the rate of one bushel per acre. The yields per acre have been estimated from the actual results of the plots:

Varieties.	Weight per measured bushel.	Yield of straw per acre.		Yield of grain per acre.	
		1895.	Average, two years.	1895.	Average, two years.
	lbs.	tons.	tons.	bus.	bus.
Japanese	46.2	2.2	3.7	19.1	19.7
Silver Hull	50.0	2.6	2.9	11.5	12.3
Common Grey	47.0	2.0	2.6	10.3	11.62

It will be observed in the foregoing table that the yield of buckwheat per acre in 1895 was very similar in amount to the average of the two years of the experiment. Silver Hull gave the heaviest weight per measured bushel, being two pounds over the standard, while the other two varieties were a little under the standard in weight per measured bushel. The Japanese has a decided advantage over the Silver Hull and Common Grey in yield of grain per acre, producing one-half as much again as either of the last mentioned varieties. The Japanese is a strong growing variety and produces large angular grain. The Silver Hull variety produced a grain smaller in size than the Japanese, but very plump and of a beautiful silvery appearance.

Winter Rye—Comparative Test of Three Varieties.

In the autumn of 1894, three varieties of winter rye were sown in the experimental department. The seed was sown broadcast on the sixth of September, at the rate of two bushels per acre. The plots were one-hundredth of an acre in size. The soil was the same as that used for the varieties of winter wheat previously described.

Varieties.	Weight per measured bushel.		Straw per acre.		Grain per acre.	
	1895.	Average 2 years.	1895.	Average 2 years.	1895.	Average 2 years.
	lbs.	lbs.	tons.	tons.	bus.	bus.
Common	57.3	56.1	3.4	4.3	46.5	51.24
Pennsylvania	58.2	56.6	3.0	4.1	39.5	51.19
Finland	58.2	.....	3 0	.....	36.1	.....

The common and the Pennsylvania varieties of rye have been grown for two years in succession and the average results from these two varieties are very similar indeed. The Finland rye gave an average of over ten bushels per acre less than the common variety. It will be observed than the yield of rye for both years was large, as the records show that there was over four tons of straw per acre, and upwards of fifty bushels of grain produced by each variety.

Spring Rye—Comparative Test of two Varieties.

In the spring of 1895, two varieties of rye were obtained and sown side by side for a comparative test. This is the first year that these varieties were grown in the experimental plots. They were sown on plots of one one-hundredth of an acre in size on April 20th. Two bushels of seed per acre were used and it was sown broadcast.

Varieties.	Weight per measured bushel.	Yield per acre.	
		Straw.	Grain.
	lbs.		bus.
Prolific Spring Rye	58.3		52.2
Dakota Mammoth Rye	59.5		51.4

The results show that the two varieties came out very close in point of yield of grain per acre, the Prolific Spring rye surpassing the Dakota Mammoth by less than one bushel

per acre. The weight per measured bushel of the Dakota Mammoth however surpassed that of the Prolific Spring rye by over one pound, which would perhaps more than counterbalance the extra yield of the Prolific Spring variety.

Grain Sown in Mixtures.

For three years past, oats, wheat, barley, and peas have been grown separately and in various combinations for the production of grain and straw. The combinations consisted of six mixtures with two kinds of grain used in each case, four mixtures with three kinds of grain used, and one mixture with all four kinds of grain used together. There were eleven mixtures in all and four varieties of grain grown separately. These were all sown in duplicate, upon plots one-hundredth of an acre in size, making in all thirty plots. The grain was sown broadcast on April 25th. Beans were grown upon the land in the summer of 1894, and no manure has been applied for several years.

Mixtures.	Yield of straw per acre.				Yield of grain per acre.			
	Sown separately.		Sown in mixtures		Sown separately.		Sown in mixtures	
	1895.	Average 3 years.	1895.	Average 3 years.	1895.	Average 3 years.	1895.	Average 3 years.
	tons.	tons.	tons.	tons.	lbs.	lbs.	lbs.	lbs.
Barley and peas	1.20	1.19	1 20	1.35	2,205	1,629	1,817	1,488
Peas and wheat	1.25	1.25	1.28	1.37	1,701	1,378	1,445	1,185
Wheat and oats	1.09	1.51	1.12	1.57	1,457	1,472	1.736	1,755
Barley and oats	1.04	1.43	1.32	1.73	1,961	1,723	2,312	2,216
Wheat and barley	1.00	1.15	1.16	1.29	1,610	1,295	1,784	1,380
Peas and oats	1.29	1.48	1.52	1.79	2,052	1,797	2,008	1,872
Barley, peas, and wheat	1.15	1.21	1.24	1.49	1,839	1,436	1,693	1,516
Peas, wheat, and oats	1.21	1.41	1.48	1.79	1,736	1,539	1,895	1,758
Barley, wheat, and oats	1.04	1.43	1.41	1.73	1,676	1,521	2,033	2,019
Barley, peas, and oats	1.18	1.37	1 49	1.72	2,072	1,716	2,227	2,064
Barley, peas, wheat, and oats	1.14	1.34	1 58	1.77	1.831	1,559	2,169	1,952

It will be observed in the table that the grains when sown in mixtures gave larger yields of grain per acre in nine out of eleven reports in the average for three years. It will also be observed that in the average of three years' experiments, *barley and oats* mixed before seeding gave larger yields per acre than any other crops sown separately or in combination. The lightest average yield of grain per acre was produced by a combination of peas and wheat. In yield of straw per acre, the grain which was sown in mixtures gave as large or larger returns in each of the eleven experiments during each of the three years in which this experiment has been conducted.

Spring Grains—Selection of Seed.

A great deal has been said and written in regard to the selection of our domestic animals in order to produce animals for special uses. Men have had their ideals of horses, cattle, sheep and hogs, and have worked for years in breeding along certain lines, in order to bring their animals as near as possible to these ideals. Great improvements have been made in this way in all kinds of farm animals; and, as a result, we find some very excellent breeds which usually produce their offspring nearly true to type. Not only has this work been carried on by a few talented men who have had special capabilities for such

work, but much has been accomplished by stock-breeders as a class. Careful and successful stockmen take much pains in the selection of the animals which they handle in order to obtain the greatest practical results along the lines on which they are working.

It seems strange that there has been so little care exercised in the selection of seed for the farm when there has been so much care given to the selection of the farm animals, and with such good practical results Some individuals have made the selection of grain a prominent feature and have had good success in their efforts. It cannot be denied, however, that farmers in general devote altogether too little attention to this very important feature in connection with their farm operations. The experimental department at the College is doing a considerable amount of work in the selection of seed for farm use; and it is the intention to extend this work to a considerable extent by the careful selection of seed and by cross-fertilization of the varieties that have already proven the most successful among those grown for a number of years in succession in the experimental department. A considerable amount of advantage has already been shown to result from the selection of seed during the last seven years in a general way, and during the past four years in special experiments conducted with direct objects in view. During the past season thirty-four plots were devoted to experiments in the selection of spring wheat, oats, barley and peas, and the majority of these are reported upon in the following pages. These were conducted in the central part of our experimental field. The land was plowed the previous autumn and was thoroughly cultivated in the spring before the seeding took place. Owing to pressure of work the seeding did not take place until the early part of May; but the plots of each experiment were sown on the same day in every instance. The grain was sown broadcast on plots one hundred and sixtieth part of an acre in size. The yields per acre are estimated from the actual yield of the plots.

Barley—Selection of Seed

Large plump, small plump, shrunken and cracked barley were sown on experimental plots in 1894 and in 1895. The small plump was sown on two plots during each of these years; upon one plot the same weight was used as that of the large plump seed, and on another the same number of grains was used as was sown of the large plump grain. The same can also be said of the shrunken grain. The two plots with the small grain, as well the two ts with the shrunken grain, were averaged during each of the years. The ame weight of cracked grain was used each year as was used for the large plump selecion.

Selections.	Weight per measured bushel.		Yield of straw per acre.		Yield of grain per acre.	
	1895.	Average 2 years.	1895.	Average 2 years.	1895.	Average 2 years.
	lbs.	lbs.	tons.	tons.	bus.	bus.
Large plump	49.0	49.8	1.44	1.40	38.2	42.5
Small plump	48.3	49.0	1.24	1.36	35.3	38 5
Shrunken	47.7	48.7	1.15	1.23	33.1	34.6
Cracked	46.5	48.4	1.00	1.28	30.0	32.5

It will be observed by the above table that the large plump gave the best results in yield of straw per acre in weight per measured bushel, and in yield of grain per acre in both the results for 1895 and for the average of two years. The shrunken grain gave an average of about nine bushels per acre less than the large plump grain in the average of the experiments for two years.

Spring Wheat—Selection of Seed.

When selecting the large plump seed, great care was exercised to have grains of a uniform and symmetrical type throughout. The kernels selected under the heading of "Shrunken" were usually of good size, but were quite angular on their surface owing to a lack of full development. The small plump seeds were apparently good in every way except being small in size. In weight of grain per measured bushel the large plump seeds gave nearly three-quarters of a pound more than the produce of the shrunken seed in the average of three years. There is quite a marked advantage in favor of the large plump seed in yield of grain per acre for 1895 and for the average of three years.

Selections.	Weight per measured bushel.		Yield of straw per acre.		Yield of grain per acre.	
	1895.	Average 3 years.	1895.	Average 3 years.	1895.	Average 3 years.
Large plump seed	61.5	60.14	1.65	1.32	31.6	21.9
Small plump seed	61.4	60.01	1 27	1 03	21.7	17.4
Shrunken seed	61.2	59.50	1 34	1.06	25 8	17.9

It will be observed that in the average results for 1893, 1894 and 1895 the large plump seed gave four and a half bushels per acre more than the small plump grain which has an increase of about twenty per cent. Shrunken seed produced four bushels of grain per acre less than the large plump seed in the average of three years, during which time these experiments have been conducted. Not only is there an advantage in the weight of grain per measured bushel and in grain per acre, but it will be seen that in the yield of straw per acre the large plump seed produced about one-third more straw than was produced by the small grain. There was also nearly as great a difference in the yield of straw between the shrunken seed and the large plump seed.

Sound and Cracked Peas for Seed.

Selections.	Yield of straw per acre.				Yield of grain per acre.				
	1892.	1893.	1895.	Average 3 years.	1892.	1893.	1894.	1895.	Average 4 years.
	tons.	tons.	tons.	tons.	bus	bus.	bus	bus.	bus
Whole peas	1.54	1.01	1.16	1.24	25.9	19.8	18.8	48.5	28.3
Cracked peas	.86	.27	.60	.58	12.2	4.4	.8	20.0	9.4

For four years in succession we have sown plots with whole peas and with peas which have been cracked by the machine. The same weight of grain was sown in every instance. The results are exceedingly interesting and should be carefully noted. It will be seen by the foregoing table that in every instance the whole peas gave much larger returns than cracked ones in yield of both grain and straw. There was not one of the four years in which these experiments were conducted, but the yield of grain was more than doubled from the whole peas as compared with cracked ones. In the average of the experiments of 1892, 1893, 1894 and 1895, the whole peas gave 28.3 bushels per acre and the cracked peas 9.4 bushels per acre. These plots when growing were exceedingly interesting and were observed by a great many farmers during the past season. One day in the month of June, while a company of farmers were looking at these two plots growing side by side, a gentleman said that that was a grand object

lesson for him as he was in the habit of getting his peas thrashed by a machine and then sowing the thrashed grain, and he thought perhaps one-third of the peas were cracked. He had considered that if the germ was not in one-half it would be in the other half and would grow all right. He said that in the future his plan would be to clean carefully out the cracked peas and feed them to his hogs and sow none but those which were whole. Is it not a fact that a great many farmers thrash their peas with a machine and sow a proportion of cracked grain each spring? It would be far more economical for them to feed the cracked grain instead of sowing it to rot. In 1894 only seven per cent. of the cracked peas grew; and in 1895 only about twenty per cent. were seen to germinate.

Buggy Peas for Seed.

In 1894 and in 1895 peas were selected, each of which had been partially eaten by the pea bug, (*Bruchus pisi*). In 1894 a very small pea was used for this experiment, and only twenty-four per cent. of the peas sown germinated. In 1895, however, a larger variety of peas was selected for this test and evidently the ravages from the bug did not effect such a large percentage of the germs as forty-five per cent. of the grains germinated. Consequently in the average tests of two years, 34.5 per cent. of the grains which were sown, germinated. It would be well for those who are sowing peas to watch closely the soundness of the grain which they sow, as buggy peas would be much better fed to animals than sown, as a bushel of buggy peas contains about three-quarters as much feeding material as a bushel of sound peas; and if used for seed, only about one-third will be of any value, according to the results of the experiment. As a portion of the buggy pea has been removed, the young plants produced will not be so strong and vigorous as those grown from sound peas. This fact has been quite visible in the plots used for this experiment.

Selection of Seed—White Oats.

In 1894 and in 1895 experiments were conducted, in which large, plump, medium and small size grains were used, and also double grains. It is often observed, especially in a poor season, that a small oat will be enclosed inside the hull of a larger grain. On examination, the grain would at first sight appear to be made up of a single kernel, but on further inspection, it will be found that the apparent kernel is in reality made up of two grains enclosed by the one covering. With this seed there are double as many grains sown as in any of the other selections Exactly equal numbers of grains were selected for each of the other plots in both years. In 1894, 8,160 grains were sown on each plot, and in 1895, 7,900 grains were sown on each plot.

Selections.	Wheat per measured bushel.		Yield of straw per acre.		Yield of grain per acre.	
	1895.	Average 2 years.	1895.	Average 2 years.	1895.	Average 2 years.
	lbs.	lbs.	tons.	tons.	bush.	bush.
Large plump	35.0	36.1	1.28	1.29	65.9	58.25
Medium	34.2	35.7	1.20	1.33	63.4	52.43
Small	34.2	36.1	1.42	1.43	62.2	47.29
Double	34.7	36.2	1.28	1.35	58.8	48.96

It will be observed in the foregoing table that large, plump seed gave the largest yield of grain per acre in 1895, and also in the average of the two years' experiments. The medium-sized seed came second in point of yield per acre. In the average of the two years' experiments, we find that the large seed gave an average of eleven bushels per acre more than the small seed.

Selection of Seed for Two Years in Succession.

In 1895 barley, spring wheat, oats and peas were grown from seed selected from the crops produced in 1894, which were also produced from selected seed. It was found, however, that the peas were not all true to name, some of the smaller ones being not of the same variety as the largest ones which were selected. This part of the experiment is, therefore, not reported upon. In order to give a good idea of the results from the selection of seed during the second year, the average number of grains per ounce in each selection of seed is given in the following table :

Class of grain.	Average number of grains per ounce of crop from seed.		
	Large plump.	Small plump.	Shrunken.
Barley	600	704	807
Spring wheat	958	1137	1023
Oats	1143	1161	1196

It will be observed that the largest grains in every instance were produced from the large, plump kernels, which were sown. In the barley experiment the shrunken grain produced smaller kernels, than the small plump ; but in the spring wheat exactly opposite is the case, the small plump grains producing smaller kernels than the shrunken. In the case of the oats, the results from the three selections are not very different, but they all point in the one direction, namely, that the best grain sown produced the best grain in the succeeding crop. This work will likely be continued for several years, until a large amount of valuable information can be gathered along this important line of investigation.

Selection of Seed—Joanette Oats.

For three years in succession, we have carried on an experiment with the Joanette variety of oats, endeavoring to glean some information in regard to the cause of the tendency of black oats to become lighter in color, when grown in Ontario for several years ; the germination of oats from which the hull has been removed by the separator as compared with the germination of oats with the hull on ; and the tendency of oats sown with the hull on to produce a crop of grain less liable to be hulled in the thrashing than the previous crops. In carrying on this experiment, we have used seed from the crop of the different plots of the previous year. As it has been found to be the tendency of the Joanette oats to become very badly hulled in thrashing, this particular variety was selected for this experiment. In the past two years exactly the same number of grains were sown upon each plot, there being nine thousand one hundred and fifty-seven grains sown upon each plot in 1894, and seven thousand three hundred and one sown upon each plot in 1895. The grain was sown broadcast on plots one hundred and sixtieth acre in size.

Selection.	Number of grains per ounce. 1895.			Weight of grain per measured bushel.			
	Total.	Hulled.	Not hulled.	1893.	1894.	1895.	Average 3 years.
				lbs.	lbs.	lbs.	lbs.
Large plump	1,288	146	1,142	32.3	34.5	32.9	33.2
Light	1,330	132	1,199	30.3	32.8	31.1	31.4
Hulled	1,358	252	1,105	33.8	34.9	33.4	34.0

Owing to some trouble from sparrows destroying a small amount of the grain after being shocked, the yield of grain from the different plots cannot be given during the present year. We have, however, examined the grain, and found the results to be quite interesting. It will be observed that the grain produced by sowing large plump seed possesses heavier kernels than that produced from the sowing of light grain. The greatest amount of hulled grain was produced from the crop raised from the hulled seed. It took eleven hundred and ninety-nine kernels from the crop produced by sowing light seed to weigh an ounce, as compared with eleven hundred and forty-two kernels obtained from the crop produced by the large plump grain. In weight per measured bushel, we find that we have obtained the same comparative results during each of the three past years. From sowing hulled kernels, we obtained the heaviest weight of grain per measured bushel; from sowing the large plump kernels we obtained the next heaviest weight of grain per measured bushel; and from sowing light kernels, we obtained the lightest weight of grain per measured bushel. There was a difference of about two pounds per measured bushel of grain from large plump kernels, as compared with the light kernels, in the average of three years' experiments.

Spring Grain, Different Dates of Seeding.

Barley, peas, spring wheat, and oats were sown on six different dates in the spring of the present year, starting on April 18th and finishing on May 25th. The experiments were conducted in duplicate in every case by using two varieties of each of the kinds of grain mentioned. This makes the fifth year in which this experiment has been made; but, owing to unfavorable weather at the proper times of seeding, we were compelled to drop the experiment entirely for one year, and partially in one or two of the other seasons. We, however, have results of seeding on three of the dates mentioned, for four different years.

In 1895, forty-eight plots were devoted to this experiment, the plots being one-hundredth of an acre in size in every instance. The land on which the experiment was conducted lay somewhat low and had received farmyard manure at the rate of twenty tons per acre in the spring of 1894, during which season it produced a crop of roots. The grain was sown broadcast and at the same rate of seed per acre as was used in the variety tests. The yields per acre in the following table have been estimated from the actual results of the plots for the past season:

Results from Sowing Grain at Six Different Dates in 1895.

Dates of Seeding.	Weight per measured bushel					Yield of grain per acre.				
	Barley.	Peas.	Sp. Wheat.	Oats.	Average.	Barley.	Peas.	Sp. Wheat.	Oats.	Average.
April 18	52.38	61.25	60.63	36.13	52.60	46.63	32.60	22.30	101 85	51.10
April 22	52.88	61.32	59.75	34.75	52.18	46.75	35.65	17.03	109.29	52.18
May 1	49.75	62.13	59.88	34.88	51.66	42.71	41.93	16.72	99.74	50.28
May 9	45.63	62.32	60.38	33.13	50.37	38.15	43.70	15.68	92 29	47.46
May 18	49.13	61.63	60.63	33.25	51.16	33.08	38 68	12.13	67.09	37.75
May 25	43.00	61.69	61.25	31.50	49.36	23.19	37.50	14.48	73 32	37.12

It was previously mentioned in this report that between the 12th and 23rd of May of the present year there were frosts at the Agricultural College on eight separate nights, the thermometer reaching as low as ten degrees below freezing point on the night of May 20th. At this time the grain sown on the 18th and 22nd of May was all growing nicely, and that sown on May 1st could be seen growing above the ground. We, therefore, have some interesting results to record this season, in showing the effects of quite severe and continued frosts upon four kinds of young growing grain crops.

It will be observed from the above table, that the largest yields of grain per acre of spring wheat, were obtained from the first seeding; of barley and oats from the

first seeding ; and of peas from the fourth seeding. The increases and decreases are quite regular throughout, except in the case of the last two seedings. It will be observed that the barley and peas gave larger yields per acre from the seeding of May 18th than that of May 25th, while exactly the opposite is the case with spring wheat and oats. In the average of the four grains sown, the seeding of April 22nd, gave the highest yield of grain per acre, and that of April 18th, the second highest. There was a gradual decrease in the average yield of grain per acre, from the second to the last dates of seeding. In weight of grain per measured bushel, it will be observed that the oats gave the largest weight from the first seeding, the barley from the second seeding, and the peas from the fourth seeding. The average weight per measured bushel of the spring wheat from the different dates of seeding is rather peculiar and different from that of other years. As it will be observed that the heaviest grain was produced on May 25th and there was a gradual decrease in weight per measured bushel up to the first date of seeding, at which time it equals that of the fifth seeding. The results, however, are very similar with the two varieties of spring wheat used in this experiment. To show how very careful the results of these experiments are worked up, it might be mentioned that two varieties of each kind of grain were used, and all weights were carefully determined by two individuals independent of each other ; and where any difference occured between the two weighings, the grain was weighed the third time.

The following table gives the results of four kinds of grain sown on three different dates for four years in succession :

Dates of seeding	Average weight per measured bushel.				Average yield of straw per acre.				Average yield of grain per acre.			
	Barley, 4 years.	Peas, 3 years.	Spring wheat, 2 years.	Oats, 4 years.	Barley, 4 years.	Peas, 3 years.	Spring wheat, 4 years.	Oats, 4 years.	Barley, 4 years.	Peas, 3 years.	Spring wheat, 4 years.	Oats, 4 years.
April 21-22	50.02	60.05	60.13	33.81	1.16	1.20	1.23	1.88	35.81	33.75	18 31	67.87
May 1	48.08	61.25	59.44	33.04	1.22	1.27	1.06	1.74	35 05	36.34	14.61	65.15
May 9	45.62	61.93	58.54	30.72	1.10	1.16	.92	1.50	26.17	33.51	11.14	58.75

The results in the above table should be of much value, as the experiments extend for a period of four years, and they cover pretty thoroughly the period of sowing the leading kinds of grain in a climate somewhat similar to that of Guelph. If early sowing has a marked influence in increasing the yield and the quality of grain in Wellington county, it is quite likely the rule will hold good in other sections of the Province, although exactly the same dates might not be applicable in all places. It will be observed that the barley, spring wheat, and oats gave the heaviest weight per measured bushel from the first seeding, and there was a gradual decrease in this respect in the second and third dates of seeding. In respect to the peas, however, such is not the case, as the heaviest grain was produced from the seeding of May 9th, the second of May 1st, and the lightest of April 21st and 22nd. There is also a gradual decrease in the amount of grain per acre of barley, spring wheat and oats, when we compare the results of the second and third dates of seeding with those of the first. It should be carefully observed, however, that the peas gave an average of nearly three bushels per acre more from the seeding of May 1st than from the seeding on the 9th of May, or of April 21st and 22nd. The reader will observe that there was only about nineteen days from the first to the last dates of seeding ; but there was a decrease of about ten bushels per acre of barley, seven bushels per acre of spring wheat, and nine bushels per acre of oats, from the last date of seeding as compared with the first.

Spring Grain—Drilling *vs.* Broadcasting.

In the spring of 1895, barley, peas, spring wheat and oats were sown both with a drill and by hand on plots lying side by side. There were two varieties of each kind of grain used for this experiment, thus making sixteen plots in all. The plots were one-hundredth

of an acre in size in every instance. Seeding took place on April 19th. The land on which this experiment was conducted lay low, and produced a crop of roots in the year 1894, before which it received a dressing of twenty tons per acre of farmyard manure. The following are the results of the experiment:

Methods of seeding.	Yield of straw per acre.		Yield of grain per acre.	
	1895.	Average for 2 years.	1895.	Average for 2 years.
	tons.	tons.	bushels.	bushels.
Broadcast	2.03	1.96	53.23	49.42
Drilled	1.86	1.91	51.07	48.69

In 1893 the drilled grain gave about three quarters of a bushel per acre more than that which was sown by hand. In 1895, however, the broadcasted grain gave an average of over two bushels per acre more than the drilled It must be remembered that the date of seeding was very early, this experiment being one of the very first that was undertaken. The ground at that time contained plenty of moisture, and was likely cold underneath. Hence the broadcast grain had the advantage of getting the full benefit from the surface soil, which would be warmed by the sun during the day. Had the grain been sown some days later the results might have been considerably different. In the future this experiment will likely be made by sowing at different dates, in order to see the influence from the two methods of sowing at times when the ground is likely to be in somewhat different conditions.

POTATOES AND ROOTS.

The number of plots devoted to experiments with potatoes and roots during the year 1895 was 740 These were almost equally divided between the two, there being 376 plots of roots and 364 plots of potatoes. The land upon which the potatoes were grown had not produced a crop since it was broken up, it being comparatively new land. The land devoted to the root experiments had been cropped for a good many years. The crops for the variety tests were one-hundredth of an acre in size, with but a very few exceptions. Besides the experiments with varieties, a large number of tests were made in the method of cultivation and in the selection of seed with both potatoes and roots.

Potatoes—Comparative Test of 184 Varieties.

Thirteen new varieties of potatoes were introduced and grown in the trial grounds in 1895 for the first time This makes in all 184 varieties which were grown during the past season The seed of the different varieties which we now have under experiment was obtained from Nova Scotia, Prince Edward Island Quebec, United States and Ontario. Twenty-three of the varieties have been grown for six years in succession, and sixteen for five years; but, to bring all these varieties into the same table for the sake of comparison, the reports for only the last five years are included in the following summary results. This makes thirty nine varieties grown for five years in succession upon plots side by side. The varieties were all grown on new land without any manuring The varieties were all planted on May 30th and 31st on plots one hundredth of an acre in size Each plot consisted of three rows, four rods in length, the rows being a little less than twenty-seven inches apart. Fifteen pounds of each variety were used in every instance, and the plots were so divided that there were exactly 198 sets of each kind planted. The land was drilled with a double mouldboard plow, and the potatoes were placed four inches below the surface of the land. Flat cultivation was used throughout, and the application of Paris green solution was used three times to destroy the potato beetles The crop was removed from the ground with a two horse potato digger. The marketable and unmarketable potatoes were divided by means of a Pease potato sorter. The potatoes were weighed very soon after being dug. The yields pere acre were estimated from the actual results of the plots.

Potatoes—Comparative Test of 184 Varieties.

Varieties.	Result for 1895.			Average results for the number of years grown.		
	Amount of scab, 100=most, 1=least.	Yield of marketable potatoes.	Yield of whole crop.	Percentage of whole crop marketable.	Weight of 30 representative potatoes	Yield of potatoes per acre.
Grown for five years:		bush.	bush.		bush.	bush.
1 Empire State	26	245 00	261.25	94.67	12.78	204.66
2 Thorburn	44	225.83	235.83	93.99	13.00	181.51
3 Summit	43	183.95	205.42	89 37	11.89	179.36
4 Tonbocks	23	152 92	194.58	79.43	7.39	176.35
5 Convoy	18	234.17	252 50	87.93	9.46	175.56
6 Sweet St. Vernal	17	203.75	228.33	87.78	9.63	169.58
7 Beauty of Hebron	26	214.58	237.50	90 08	9.08	168.79
8 Woodbury White	27	220.42	248 33	85.78	8.94	168.60
9 Late Rose	39	212.08	236 25	88.67	9 40	167.95
10 Rural New Yorker No. 2	43	236 67	252.50	92.22	11.40	164.35
11 Rose's New Invincible	41	257.08	271 67	92.16	11.08	162.44
12 Early Sunrise	21	148.75	173.33	88.36	9 40	162.14
13 Badger State	28	219 17	241.67	87.38	10.19	161.66
14 Green Mountain	60	265.42	284.58	91.19	14.40	160.98
15 White Elephant	50	240 83	256.69	90.81	11.39	159.36
16 Advance	10	189.17	217 92	82 01	8.33	159.01
17 Early Rochester	32	228 33	245 00	87.77	9.64	158.28
18 Minister	43	207.50	220 42	93 97	11.26	158.25
19 Early Oxford	16	170 00	195.00	83.58	7.69	157.73
20 Early Mane	30	151 25	172.08	83.26	8 59	157.46
21 Early Puritan	25	182 50	202 92	89.58	10.83	157.05
22 Early Rose	19	188.75	214.58	85.24	9.26	155.91
23 Thunderbolt	12	185.42	201.67	80.55	8.70	155.57
24 Pootaluck	31	149 17	177 08	86.31	9 26	154.81
25 Daisy	35	185 83	225.83	86.58	8.64	154 29
26 Silver King	31	222.08	243.75	80.52	8.70	153.69
27 Rural Blush	31	210.83	234.17	89 79	15 51	151.87
28 Hoffman	16	173 33	189 58	79.88	7.94	150.78
29 Kosh Konong	20	161.25	172.92	87.49	9 64	142.43
30 Crown Jewel	39	169.58	202.92	84.90	9.96	142.08
31 Dakota Red	35	203.33	219.58	90 28	8.50	140.87
32 Putnam	23	180.00	202.08	76.76	8 33	140.84
33 Haiton's Seedling	34	164.58	198.33	78.13	8.08	138.58
34 Early Dominion	20	158.33	166.25	84.10	8 89	138.36
35 Ohio Junior	10	154.17	161 25	88.87	9.83	137.84
36 Early Ohio	33	140 83	157.92	84.44	8.51	133.16
37 Rosy Morn	30	150 42	172.50	82.08	7.53	124.19
38 Queen of the Valley	21	156.67	173 33	86.74	9 65	123.95
39 Stray Beauty	26	143.33	164 58	81.45	6.20	116.40
Grown for four years:						
40 Burbank's Seedling	19	234 58	255 42	83 83	9.00	199.58
41 Early Everett	25	191 25	217.08	84 77	8.95	188.34
42 Morning Star	21	287 50	310 83	82 16	8 28	185.33
43 Early Gem	23	196 25	204 58	89.93	10 51	184.06
44 Hotel Favorite	28	207.50	232 92	83.29	9.20	182.00
45 Island McDonald	15	226 25	252 08	89.18	11.20	180.61
46 The Dandy	28	197 08	223.75	81 28	8.76	180.42
47 New Queen	30	200 83	212 08	83.85	12 06	178.76
48 Landreth's State of Maine	23	2 5 00	280 00	79 29	7.95	178.46
49 King of the Roses	13	170.83	193 75	81.36	9.26	178.03
50 Edwards	19	245 00	267.50	87.15	9.69	176.38
51 N. B. & G. Co's Grand Mogul	60	227 08	249.17	92 07	9.34	176.20
52 Everett's Seedling	33	191.67	226.25	79.48	7 95	175.40
53 Delaware	33	261.67	277.92	88.00	9.14	175.31
54 St. Patrick	25	189 17	211.25	86 27	9 63	174.07
55 Thorburn's Extra Early	23	152 50	188.33	76 57	7.94	173.30
56 State of Maine	24	232.50	247 92	91 59	9 08	172.45
57 Watson's Seedling	31	180.42	214.58	80.00	8.38	172.

POTATOES—COMPARATIVE TEST OF 184 VARIETIES.—*Continued.*

Varieties.	Result for 1895.			Average results for the number of years grown.		
	Amount of scab, 100 = most, 1 = least.	Yield of marketable potatoes.	Yield of whole crop.	Percentage of whole crop marketable.	Weight of 30 representative potatoes	Yield of potatoes per acre.
Grown for four years.—*Con.*		bush.	bush.		bush.	bush.
58 Mammoth Pearl	14	166.67	175.00	88 53	9.63	**172.20**
59 Molly Star	15	144.58	162.92	81.17	8.95	**171.67**
60 Alexander's Prolific	33	250.00	262 50	85 85	9.53	**171.54**
61 Wilson First Choice	32	247.92	275.83	80.26	8.34	**171.27**
62 Polaris	23	154.17	180.83	80.93	8.45	**170.85**
63 Harbinger	11	195.83	277.08	59.44	7.14	**169.76**
64 White Star	32	140.42	146.67	90 57	12.76	**169.67**
65 Burpee's Extra Early	16	158.33	195.00	77.13	6.96	**168.95**
66 The Ideal	21	171.67	202.92	79.37	7.31	**167.82**
67 Paris Rose	23	154.58	185.00	73 55	7.53	**167.30**
68 Early May Flower	21	174.17	210.83	77.39	7.33	**165.54**
69 Halo of Dakota	39	160.42	200.42	81.86	7.40	**165.29**
70 Dempsy's Seedling	14	183.33	206.67	83.16	8.63	**163.57**
71 Vick's Perfection	23	153.33	182 08	86.90	8 46	**162.80**
72 Munroe's Co. Prize	38	166.67	188.75	83.92	10.14	**162.46**
73 May's Imperial	23	155 83	168.33	85.20	9.25	**161.87**
74 Red Australian	28	161.25	177.92	88.81	8.51	**161.55**
75 Early Market	39	180.42	190-42	91.34	9.26	**161.13**
76 White Lily	28	204.58	227.50	83.17	9.01	**160.11**
77 Landreth's Alliance	19	197.92	227.50	88.11	9.90	**159.80**
78 Early Essex	16	172.92	205.42	80.64	8.20	**159.57**
79 Vick's Champion	12	176 67	189 58	89.86	10.08	**157.19**
80 Mount Carbon	7	172 92	186.25	84 98	9.21	**157.08**
81 Chautauqua	18	182.50	196.67	89 65	9 39	**166.88**
82 Chicago Market	3	163.75	181.67	82.40	8 64	**156.28**
83 Bell A. C	17	220 00	228.33	88.65	9.50	**156.37**
84 P. E. I. Early Rose	3	167.08	181 67	89.22	9.45	**156.06**
85 Bowley's Northern Spy	33	190.00	207.50	86.71	9.75	**155.12**
86 The Rosedale	14	174.58	190 00	83.12	8 34	**155.10**
87 Garnets	20	250.42	161.67	87.41	10 09	**153.95**
88 Extra Early Vermont	16	195.83	208.33	83 68	9.20	**153.65**
89 Landreth's Garfield	16	166 67	204.17	76 27	7.56	**153.55**
90 Negro	73	67.08	155.42	58.21	5 38	**152.31**
91 Eureka	47	119 58	147.50	78 59	7.71	**151.55**
92 Prince Albert	18	154.58	173.33	79.83	8.13	**149.39**
93 Sunlet Star	23	115 00	145.83	75.18	7.95	**148 63**
94 Rose Seedling	23	186.25	195.42	93.21	11.33	**147.59**
95 Snowflake	23	115.42	196.67	55.34	5.09	**146 80**
96 Hopeful	34	195.83	207.08	86.18	9.81	**146.80**
97 Royal Adelaide	6	192.50	205.00	88.10	9.33	**145 05**
98 Snow Queen	30	155 83	195.83	73.38	6.83	**145.00**
99 Chas. Downing	24	103.33	183.33	56.74	4.96	**143.21**
100 Vaughan	12	145 42	155.83	90.23	10.03	**139.92**
101 Lady Finger	10	84.17	179.58	42.68	5.19	**138.25**
102 McIntyre	23	154.58	176.25	84.36	9 34	**135.41**
103 Pearce's Prize Winner	14	67.08	85.42	83.62	9.06	**93.08**
Grown for three years:						
104 Pearl of Savoy	28	247 08	255 00	95 99	16 50	**242.36**
105 American Wonder	28	247.50	275.00	89.75	12 35	**242 07**
106 American Giant	33	220.83	235.42	93.08	13.92	**236.93**
107 Columbus	24	260.42	275.83	91.64	12.92	**236.68**
108 Burpee's Superior	16	246.25	267 92	88.78	11.00	**228.77**
109 Bill Nye	34	220 83	243.75	88.52	10 50	**218.60**
110 Early June Eating	23	212.08	223.33	90.06	13.17	**206.80**
111 Early Pontiac	30	172.50	201.25	83 54	8.10	**205.30**
112 Scotch Regent	35	204 58	223 75	83.66	9.50	**205.28**
113 Keiser	26	195.00	203.33	93.40	10 83	**204.42**
114 Nebula	23	156.67	185.00	83.73	12.77	**200.55**

POTATOES—COMPARATIVE TEST OF 184 VARIETIES.—*Continued.*

Varieties.	Result for 1895.			Average results for the number of years grown.		
	Amount of scab, 100 = most, 1 = least.	Yield of marketable potatoes.	Yield of whole crop.	Percentage of whole crop marketable.	Weight of 30 representative potatoes	Yield of potatoes per acre.
Grown for three years.—*Con.*		bush.	bush.		bush.	bush.
115 Improved Rose	10	181.25	193.75	89.89	11.00	**198.86**
116 Early Harvest	12	159.58	183.33	88.35	9.83	**197.08**
117 Montana Wonder	9	203.75	230.00	79.63	10.35	**196.11**
118 Early Yorker	18	194.17	211.25	88.56	12 42	**195.55**
119 Arizona	39	167.08	177.08	88.26	12.77	**195.53**
120 Early Six Weeks	33	175.42	200 00	84.52	9.92	**194.99**
121 Rochester Rose	21	185.83	196.67	92.76	12.18	**194.87**
122 Granger	8	203.33	225.42	87.11	10.18	**194.30**
123 General Gordon	10	210.83	222.92	94.90	12.58	**188.83**
124 Bruce's White Beauty	16	167.50	190.00	83.19	8.92	**187.23**
125 Timpe's No. 4	27	163.33	174.17	89.31	11 85	**186.41**
126 North Pole	17	128.75	148 33	83.59	9.83	**185.84**
127 Golden Harvest	17	159.17	175.42	86 62	10.27	**184.31**
128 Van Orman's Earliest	5	164.17	187.08	84 72	8.67	**182.64**
129 Six Weeks	10	139.17	145.83	92.69	11.33	**181.94**
130 The Freeman	6	149.58	185.00	80.26	8.52	**180.29**
131 Steele's Earliest of all	22	137.50	158.33	85 90	8.83	**179.88**
132 The People	5	188.75	199.17	91.14	11.18	**178.45**
133 Beauty of Beauties	20	150.42	162.50	88.53	10.50	**178.06**
134 Early Nor her	10	112.92	127.50	91.13	11.43	**176.39**
135 Reid's Eighty-Six	7	157 92	183.75	83.99	10.42	**176.13**
136 Potentate	31	129 58	133.75	89.52	12.92	**173.06**
137 Parson's Prolific	11	124.17	136.25	89.25	11.08	**166.66**
138 Seneca Beauty	15	164.17	170.83	97.15	16.68	**166.54**
139 World's Fair	38	120.42	133.33	85.64	9.58	**166.12**
140 Browall's Seedling	6	133.33	145.83	91.82	13.17	**165 72**
141 Ontario	4	161.25	182 92	86.73	12.17	**164.03**
142 Pride of Irelan l	12	112.92	123.33	90.27	11.27	**162.37**
143 Manitoba Rose	8	167.08	186.25	89.07	10.42	**159.31**
144 Maggie Murphy	10	185.42	185.83	94 25	13.33	**153.56**
145 Columbian Peach Blow	5	155 00	176 25	77 35	8.33	**150.30**
146 Great West	12	144.58	165.00	82.46	10.92	**149.03**
147 Howe's Premium	13	127.92	139.17	90 28	7.88	**144.58**
148 Eyeless	14	97.08	154.58	66 73	7.42	**136.25**
149 New Satisfaction	13	107.08	127.08	72 57	8.35	**126.41**
Grown for two years:						
150 Great Divide	20	225.00	254.58	92.39	11.63	**301.04**
151 Troy Seedling	16	257.50	277.92	94.42	14.38	**297.30**
152 Irish Daisy	17	197 50	217 50	92.59	14.25	**264.38**
153 Adirondack	6	229.17	247.92	93.41	11.75	**242.50**
154 Hartzell's Seedling	7	228 33	247.08	95.15	14.50	**241.67**
155 Snow Drop	13	192 50	232.92	84.83	13.13	**238.34**
156 Pride of the West	6	203.33	225.42	92.34	14.63	**226.67**
157 Pride of the Market	7	193.75	207.50	95.05	12.88	**224.59**
158 Clay Rose	5	170.83	185.42	94 49	18.13	**218.34**
159 Pride of the Table	2	186 25	200.83	94.65	15.63	**215.21**
160 Clark's Nonesuch	7	177 08	188 75	96 00	15.63	**208.96**
161 Salzer's Prize Taker	7	111.66	129.17	89.22	11.88	**202.50**
162 Russell's Seedling	4	160 83	184.17	89.10	10.50	**199 38**
163 Victor Rose	7	157 50	168.33	95.33	18.63	**199.17**
164 Governor Rusk	4	125.42	159 58	86.62	11.00	**196.67**
165 Restaurant	7	171 25	188 33	92.85	13 75	**189.79**
166 Bell's Stray Beauty	2	157 50	170 42	92 75	8.25	**181.45**
167 Vanguard	2	105 00	128 33	87.08	12.38	**181.04**
168 Wilson's Stray Beauty	22	145 00	160 42	89 60	9 13	**172.40**
169 Vick's White Gem	15	167.50	189 58	88 50	12.63	**170 00**
170 Silver Dollar	22	98.75	123.75	85.77	9.25	**152.71**

POTATOES—COMPARATIVE TEST OF 184 VARIETIES.—*Continued.*

Varieties.	Result for 1895.			Average results for the number of years grown.		
	Amount of scab, 100 = most, 1 = least.	Yield of marketable potatoes.	Yield of whole crop.	Percentage of whole crop marketable.	Weight of 30 representative potatoes	Yield of potatoes per acre.
Grown for one year:		bush.	bush.		bush.	bush.
171 Governor Forsaker	14	230.42	265.00	86.95	12.50	**265.00**
172 Fillbasket	19	231.67	251.67	92 05	16 00	**251.67**
173 Rose of Erin	28	240.00	245.83	93.56	16 50	**245.83**
174 Burnaby Mammoth	17	206.67	227.92	90.68	14.25	**227.92**
175 Early White Prize	18	178.33	210.42	84.75	11.50	**210.42**
176 Early Advancer	21	168.75	206.25	81.82	11.25	**206.25**
177 Lee's Favorite	19	175.42	203.33	86 27	11.25	**203.33**
178 Early Pride	17	157 50	198.75	79.25	11.00	**198.75**
179 Michigan Blues	6	180.00	192.50	93.51	12.75	**192.50**
180 Dreer's Standard	20	160.00	191.25	83.66	12.50	**191.25**
181 Rot Proof	10	158.33	174.17	90.91	14.75	**174.17**
182 Irish Cups	4	121.25	148.33	81.74	8.50	**148.33**
183 Earliest Known	3	124.58	137.92	90.33	11.00	**137.92**

The year 1895 gave us a very good yield of potatoes, although they were considerably affected with the scab. There were less than a dozen rotten potatoes in the entire crop, of which there was about four acres in the experimental department. Some of the best varieties were originally obtained from Ontario and the United States.

Empire State. It will be observed from the foregoing table that the Empire State stands at the head of the list in the yield of potatoes per acre among thirty-nine varieties, grown for five years in succession. It gave an average of 204.7 bushels per acre, which is about twenty-three bushels per acre more than the next highest yielding variety. Not only is the Empire State an excellent yielding variety, but it is also a potato of good quality, being one of the best in this respect among thirty leading varieties which were tested by three judges who did the work independently of each other. The Empire State has given an average of 94.6 per cent. of its crop as marketable potatoes in the results of four years. In the co-operative experiments over Ontario during the year 1895, the Empire State also stands at the head of the list among six leading varieties successfully tested upon fifty-two different farms, with an average of 205 bushels per acre. It will be remembered that the Empire State stood the highest in the average yield per acre in the average of thirty-eight co-operative experiments over Ontario in the year 1894. The Empire State and the Pearl of Savoy gave the largest amount of marketable potatoes over Ontario in 1895.

Thorburn. The Thorburn variety of potatoes stands next to the Empire State in yield per acre for five years. It is also a good potato for table use, and is a little earlier than the Empire State. It was considerably more affected with the scab during the past year than the variety already described. Thorburn has not yet been sent out for co-operative tests.

Summit. The Summit variety has made a very good record, but appears to be not quite so good in quality as the Empire State. It is also a little below the average of Empire State in the yield per acre, and in the percentage of the crop which is marketable. The Summit was one of the six varieties sent out for co-operative tests over Ontario in 1894, and occupied fourth place in the average yield per acre during that year. It was also one of the six varieties distributed during the present year, and occupied fifth place in the average of the fifty-two successfully conducted experiments, producing twenty-four bushels per acre less than the Empire State. It also occupies a lower place than Empire State in percentage of crop marketable and in table quality.

Tonhocks. The Tonhocks is a new variety obtained from the United States in the spring of 1891 It is one of the best yielding among the early varieties, producing only three bushels per acre less than the Summit. The potatoes are much smaller in size than many of the other varieties, but we usually find that the early kinds of potatoes produce tubers of much smaller size than those which mature later.

Pearl of Savoy. Among the varieties of potatoes which we grew for the first time in our plots in 1893, and which have now been tested for three years in succession, the Pearl of Savoy stands the highest in the average yield of tubers. It will also be observed that this variety possesses a large amount of marketable potatoes, the average of the three years being nearly ninety-six per cent. of the whole crop. In the co-operative experiments over Ontario, during the past year, it stands fourth in the yield of potatoes per acre, and in 1894 it occupied second place in this respect.

American Wonder. The American Wonder has been grown in our trial plots the same length of time as the Pearl of Savoy, and occupies second place in the yield of potatoes per acre. It is a new variety and was obtained in the United States. This variety is sometimes called the American Wonder and sometimes Vick's American Wonder. It is late in maturing, and has usually twice as many small potatoes as the Pearl of Savoy. It was distributed over Ontario for co-operative experimental work for the first time in 1895, and stands third in the yield of potatoes per acre in the average of the successfully conducted tests on fifty-two different Ontario farms. When tested in the autumn of the year immediately after harvest, the table quality of the American Wonder was reported upon as not being quite equal to the other varieties under experiment. The best in table quality of those tested in 1895, was the Burpee's Extra Early.

Great Divide. Among the newer varieties of potatoes, the Great Divide has made a very fine record indeed, giving an average of over 300 bushels per acre for two years, with nearly ninety-three per cent. of its crop as marketable potatoes. This variety has not been tested yet in our co-operative work, nor has the table quality been closely determined in comparison with some of the older varieties.

Potatoes—Different Depths of Planting Seed Tubers.

For five years in succession, potatoes have been planted one, three, five and seven inches deep in the experimental department. During the past year, Vick's American Wonder, Great Divide, Stray Beauty, and the Freeman varieties of potatoes were used for this experiment, each one of which was planted at the four different depths mentioned. The experiment was also conducted with four varieties in 1894; and with two varieties during each of the years 1891, 1892 and 1893. There has, therefore, been no less than fourteen separate tests made in connection with this one experiment. In 1895, each plot consisted of one row, four rods in length. The nature of the soil and the method of preparation were the same as for the variety tests. The potatoes in the experiment were all planted on June 4th. The following table gives the average results for 1895, and for the five years in which this experiment has been conducted:

Potatoes.—Different Depths of Planting Seed Tubers.

Depths of planting.	Results for 1895.			Average yield per acre for 1891 2-3-4-5. (14 separate tests.)
	Depth of new potatoes in the soil.	Number of potatoes exposed to the sun per 100 hills.	Yield of whole crop per acre.	
	inches.			
One inch	1.5	18.3	143.13	200 21
Three inches	3.4	3.0	148 75	208 35
Five inches	4.4	.0	149.06	217 52
Seven inches	4.9	.0	144.69	212.58

In the five years' experiments in planting potatoes at one, three, five and seven inches deep, the largest average yield per acre of potatoes was obtained from planting five inches deep; the second largest from planting seven inches; the third largest from planting three inches, and the lightest yield per acre from planting one inch deep. It will be noticed that the potatoes planted five inches deep in 1895 gave the largest yield of crop, and those planted one inch deep gave the smallest yield. The best yield per acre was obtained from planting seven inches deep in 1891 and 1892, five inches deep in 1894 and 1895, and three inches deep in 1893. It must be remembered that these are the results from the soil of this farm, which may be termed an average clay loam, and which is fairly well underdrained.

It was observed that a few of the potatoes from the shallowest plantings were expcsed to the sun, and an accurate account was made during the past year in order to find out the exact quantity of potatoes that was injured from being sunburned. It was found that in those from planting one inch deep, there were eighteen potatoes which were exposed in 100 hills of crop. The potatoes which were planted three inches deep had three potatoes exposed to the sun in each hundred hills of crop, while those planted five inches and seven inches deep contained no sunburned potatoes. It was also found that the potatoes planted seven inches deep produced a crop which was on the average four and three-quarter inches below the surface, while in the case of planting the sets only one inch deep the crop was on the average of one and a half inches below the surface.

Potatoes—Different Methods of Preparing Seed.

This experiment has now been conducted for four years in succession, for the purpose of ascertaining the effect of different methods of preparing seed tubers for planting. The experiment was conducted in duplicate in 1892 and in 1893, and in triplicate during each of the past two years. In 1894 and 1895 three varieties of potatoes were used each season. The quantity of seed per acre varied according to the manner of preparing the seed. The quality and preparation of the soil was the same as that used for the comparative tests of the different varieties previously mentioned. Each plot consisted of one row, one rod long. The rows were three and one-third links apart, or a little less than twenty-seven inches. The potatoes were planted on June 4th in 1895. Great care was exercised in the selection of the potatoes for the various plots in this experiment.

Preparations.	Percentage of whole crop marketable.		Yield of whole crop per acre.		Yield per acre less seed used.	
	1895.	Average 4 years, 1892-3-4-5.	1895.	Average 4 years, 1892-3-4-5.	1895.	Average 4 years, 1892-3-4-5.
			bus.	bus.	bus.	bus.
Large, whole, one foot apart	84.09	82.12	403.33	340.21	101.67	**143.39**
" two feet "	88.23	87.24	279.58	251.67	128.75	**150.81**
" three " "	86.86	89.37	218 75	204.61	119.02	**140.37**
Medium, whole, one foot "	84.23	84.79	317.08	278.73	181.57	**190 14**
" two feet "	90.85	90.03	264.17	217.62	196.40	**173.32**
Small, whole, one foot "	91.20	89.31	208.33	208.36	185.83	**182.13**
Medium, cut in two, one foot apart	80.43	85.49	213.33	196.67	149.38	**151.22**
Medium, two eyes in a piece, without seed ends, one foot apart	94.88	92.53	97.50	143.36	71.85	**125.93**
Medium, one eye in a piece, without seed ends, one foot apart	96.70	92 33	75.83	88.03	59.42	**77.80**
Medium, seed ends, one foot apart	91.46	87.33	34.17	92.46	28.63	**86.28**

The largest yield per acre in this experiment was produced from planting large-sized whole potatoes one foot apart in each of the four years that the experiment has been conducted. As a large amount of seed, however, is required for this method of planting, we find that if the amount of seed used is subtracted from the total yield per acre, the best average yield is produced from planting medium sized whole potatoes one foot apart. In 1895, however, the largest average yield, after the seed was subtracted from the whole crop, was given by the medium-sized whole potatoes planted two feet apart in the rows.

The highest percentage of marketable potatoes in the average of four years' trials was produced by planting sets with one and two eyes in the set; and the lowest per cent. of marketable potatoes was produced from large whole potatoes planted one foot apart. This experiment has been very interesting to witness during the growing season in each of the past four years, as the tops of the plants seemed to grow in close proportion to the size of the sets planted, the largest sets producing the largest tops, and the smallest sets producing the smallest tops.

Potatoes—Selection of Seed for Two Years in Succession.

In 1894 an experiment was conducted similar to the one already described under the heading of: Potatoes, Different Methods of Preparing Seed. In this experiment, large, medium and small-sized whole potatoes were planted side by side, and the crop was carefully harvested and stored in a cool cellar. In 1895, large, medium and small-sized potatoes were selected from the produce of large, medium and small potatoes planted the previous year. We thus had large-sized potatoes selected from a crop of large potatoes; medium-sized potatoes selected from a crop of medium potatoes, and small sized potatoes from a crop of small potatoes. Besides these, we also made a selection of very small potatoes from the produce of small potatoes grown in 1895. The term "small potatoes" in these experiments means those about one and a half inches in diameter, and the term "very small potatoes" means those of an average of about three-quarters of an inch in diameter.

Seed selected.	Percentage of whole crop marketable.	Weight of 30 largest potatoes.	Amount of seed used.	Yield per acre.	
				Whole crop.	Whole crop less seed used.
		lbs.	bus.	bus.	bus.
Large whole potatoes	85.78	9.81	36.56	129.69	93.13
Medium whole potatoes	88.02	8.94	25.24	112.19	86.95
Small whole marketable potatoes	89.31	5.75	8.51	49.69	41.18
Small whole unmarketable potatoes	84.44	3.44	1.60	14.06	12.46

The large whole potatoes produced more than eight times as many bushels of crop as the very small potatoes, and nearly three times as many as the small whole marketable potatoes. The large whole potatoes produced the largest amount of large tubers, and the very small, or unmarketable, produced the smallest-sized tubers.

Potatoes—Planting Sets of Different Sizes with one Eye in each Set.

In 1895, an experiment was conducted for the first time in which potato sets one-sixteenth, one-eighth, one-quarter, one-half, and one ounce, and also two ounces in size, were planted side by side. Each set contained only one eye. The object of this experiment was to ascertain the effect of the size of the seed tubers on the crop produced. The experiment was conducted in duplicate. Each plot consisted of one row four rods long. The potato sets were planted on June 12th and were covered to a depth of four inches. The soil was the same as that of the variety tests. The following gives the results:

Weights of the potato sets planted.	Percentage of sets that grew.	Percentage of whole crop marketable.	Weight of 30 largest potatoes.	Yield of whole crop per acre.
			lbs.	bus.
1. Each set containing 1-16 ounce and 1 eye	.76	.....	.....	2.50
2. " " " 1-8 " " 1 "	4.55	83.33	7.50	3.75
3. " " " 1-4 " " 1 "	6.06	85.00	8.50	12.50
4. " " " 1-2 " " 1 "	39.39	87.21	9.00	53 75
5. " " " 1 " " 1 "	59.09	90.00	10.75	93.75
6. " " " ounces " 1 "	87.12	91.75	12.63	158.75

The results in the above table are very interesting indeed. It will be observed that the smallest pieces planted made a very poor growth. This was likely owing to the exceedingly dry weather. Apparently the smallest pieces did not have enough nourishment to give them a start in growth. The largest-sized potatoes were produced from the largest potato sets, and the size of the potato in the crop decreased in the same order as the decrease in size of the potato sets planted.

POTATOES—PLANTING SETS OF EQUAL SIZE WITH A VARYING NUMBER OF EYES IN EACH SET.

During the past year, an experiment was carried on in the experimental department in order to obtain some information in regard to the influence of the number of eyes on pieces of potatoes as affecting the succeeding crop. Potato sets of one ounce in size were used throughout, and on number one plot, the sets contained one eye in each piece; on number two plot, two eyes; on number three plot, three eyes; on number four plot, four eyes; and on number five plot, five eyes. This experiment was also conducted in duplicate, on land similar in character and cultivation to that used for the variety test. The potatoes were planted on the 12th of June. The following table shows the results:

Pieces of potatoes planted.	Average yield of potatoes from each.	
	Set.	Eye.
	ozs.	ozs.
Each potato set containing 1 ounce and 1 eye	6.9	6.9
" " " 1 " 2 eyes	7.0	3.5
" " " 1 " 3 "	6.5	2.2
" " " 1 " 4 "	6.5	1.6
" " " 1 " 5 "	7.3	1.5

The reader will notice, by referring to the foregoing table, that the sets produced very similar results regardless of the number of eyes on each set. This experiment tends to show that a greater influence is exercised by the size of the potato sets planted, than by the number of eyes in each set. This experiment will likely be repeated for a number of years.

POTATOES—INFLUENCE OF PLASTER AND LIME WHEN SPRINKLED ON FRESH CUT SETS.

When seedsmen send potato eyes by mail to customers, it is often their custom to sprinkle the pieces with plaster. It is also the custom of some farmers to sprinkle their newly cut potatoes with plaster or lime immediately before planting. An experiment was started in 1894, in order to ascertain the influence of the plaster and lime when sprinkled over freshly cut potatoes for seed. The experiment was repeated during the present year in the same general way as the experiment in 1894. The sets for the experiment during the present year were divided into six lots with an equal number in each lot, and in such a way that all the lots were the same weight. Two of the lots were then sprinkled with plaster, two lots were sprinkled with lime, and the remaining two were left unsprinkled. The sets were kept in the cellar three days before planting. Just before planting these six lots, six other lots were prepared in exactly the same way, and all were planted in one day. Each plot consisted of one row, four rods in length. Planting took place on June 5th, and the same methods of cultivation were used in this experiment as in the experiment with the variety tests previously mentioned.

Preparation of sets.	Percentage of potatoes marketable.	Weight of 30 largest potatoes.		Yield of whole crop per acre.	
		1895.	Average 2 years.	1895.	Average 2 years.
		lbs.	lbs.	bus.	bus.
Potatoes sprinkled with plaster	89.51	10.81	19.97	184.69	291.83
" " " lime	85.92	10.88	19.63	177.50	285.94
" not sprinkled	88.52	10.56	17.97	168.75	240.42

The result of this experiment was quite similar in 1895 to that of 1894. The potatoes sprinkled with plaster gave the best results; those sprinkled with lime second best; and those not sprinkled the poorest, during each of the two years. The potatoes sprinkled with lime gave an average of over fifty bushels per acre more than those not sprinkled.

The results of the potatoes sprinkled with plaster and lime, three days before planting, seemed to give no better results than those cut and sprinkled with lime and planted immediately, when compared with the potatoes which were not sprinkled at all. The average yield per acre of all the tests with potatoes cut on the day of planting was about twenty bushels per acre more than the average of those which were cut three days before planting. These confirm the results of past experiments, in showing that larger yields per acre have been realized from potatoes cut and planted immediately, than from those cut and allowed to remain from three to five days previous to planting.

Potatoes—Planting Single Eyes from Different Parts of the Seed Tubers.

We not unfrequently hear the remark that the seed end, or small end, of potatoes should be removed and not used for seed. An experiment has now been conducted for two years in succession, in order to determine whether each separate eye in the seed end of a potato has as much value for planting as single eyes, from other parts of the same potato. To determine this, a uniform lot of potatoes were selected, and single eyes were cut from the seed end, from the middle, and from the stem end of the tubers. Great care was used in preparing the sets for this experiment. Each potato was usually divided into nine parts, and three pieces were taken from the seed end, three from the middle, and three from the stem. One eye was left in each of the pieces, and the pieces were all made of exactly the same weight. The experiment therefore is purely a test of the comparative value of the eyes, taken from different parts of the potato. Planting took place on the 8th of June. The potato sets were planted one foot apart in the rows, and were covered to a depth of four inches. Flat cultivation was used throughout, as in the case of the other potato experiments. The following table gives the results of this experiment:

Parts of the potatoes used.	Percentage of crop marketable.	Weight of 30 largest potatoes.		Yield of whole crop per acre.	
		1895.	Average 2 years, 1894-5	1895.	Average 2 years, 1894-5
		lbs.	lbs.	bus.	bus.
Seed end of potato	93.60	10.92	19.40	71.67	215 11
Middle of potato	92.13	11.25	19.17	74.17	224.59
Stem end of potato	88.80	9.08	18.50	52.08	211.98

The eyes from the different parts of the potato gave the same comparative results in yield per acre in 1895 as in the average results for the two years that this experiment has been conducted. The largest average yield of potatoes was obtained from the eyes taken from the middle of the tubers; second largest taken from those of the seed end; and the poorest from those taken from the stem end. In per cent. of crop marketable, it will be observed that the eyes from the seed end of the potato gave the best results. It must be remembered, however, that single eyes were planted in every instance, and not as is usually done by planting the whole number of eyes in the seed end of the potato.

Potatoes—Different Dates of Seeding.

Five varieties of potatoes were planted on May 4th, May 23rd, and June 13th, on plots side by side. The soil on which this experiment was conducted grew a grand crop in 1894, and was plowed in the autumn of the year and also in the spring. The

potatoes were planted to a depth of four inches, and there was one row four rods long of each variety, planted at each of the three dates mentioned. The results of the experiment are as follows:

Dates of seeding.	Total yield per acre.	Yield of marketable potatoes.	Weight of 30 largest potatoes.
	bush.	bush.	lbs.
Seeded May 4th	320.25	296.50	14.25
Seeded May 23rd	268.25	235.75	10.05
Seeded June 13th	264.75	240.50	11.35

The earliest seeding gave the largest average yield of total crop; the second date gave the next largest yield; and the last date of seeding gave the smallest. As 1895 was an exceedingly dry season, the results of another year might be different.

Submitting Seed Potatoes to Different Exposures Three Weeks Previous to Planting.

An experiment has been conducted for two years in succession, in which potatoes were carefully and evenly divided into different lots and placed in different degrees of light and heat for three weeks before they were planted; some being placed in a dark cellar, others in the cellar in front of a window, others on a barn floor, others in the greenhouse immediately below the glass, and others in the open air. Those placed in the dark cellar grew long tender sprouts, while those placed in a warmer temperature produced short and green colored sprouts. Part of the potatoes kept in the dark cellar were planted with their sprouts removed, and part with their sprouts still attached to the tubers. The potatoes were distributed to their respective places on June 7th, and the planting took place on June 28th. The following table gives the results for 1895, and also the average results for the two past years:

Places where the potatoes were kept for 21 days before planting.	Percentage of crop marketable.		Weight of 30 largest potatoes.		Yield of whole crop per acre.	
	1895.	Average 2 years.	1895.	Average 2 years.	1895.	Average 2 years.
Potatoes in root cellar in dark, sprouts off	44.12	70.76	4.63	9.07	106.25	**257.50**
Potatoes in root cellar in dark, sprouts on	60.73	79.37	5.88	13.44	119.38	**311.26**
Potatoes in root cellar in light, sprouts on	67.39	83.06	5.25	12.07	115.00	**301.25**
Potatoes in barn in light, sprouts on.	64.46	81.63	6.50	13.94	151.25	**346.25**
Potatoes in greenhouse in light, sprouts on	54.74	76.01	5.00	10.57	118.75	**274.38**
Potatoes in open-air, sprouts on	22.58	61.29	3.25	9.75	58.13	**64.07**

The largest average yield of potatoes per acre for the two years was obtained from those which had been placed in the light, on the barn floor, for three weeks before planting; and the second largest yield was produced by the potatoes kept in the dark cellar, and the long succulent sprouts allowed to remain on the seed when planted. The poorest yield during both years was obtained from potatoes exposed to the open air and subject to all the changes of the weather. It was noticed that the potatoes which were allowed to sprout and the sprouts left undisturbed were a few days earlier than those from which the sprouts had been removed.

Potatoes—Application of Fertilizers.

For four years in succession an experiment has been conducted in applying commercial fertilizers to land producing a potato crop. In 1892 and 1893, the potatoes were grown in the field to the south-east of the College building, and which was rather low in aspect. In 1894 and 1895 this experiment was conducted in the central part of the experimental field, which lies north-east of the College building. The land where the experiments have been conducted during the last two years is more elevated than that used previously. No manure had been applied to the lands for several years previous to the experiment of 1895. The plots were one-hundredth of an acre in size. The drills were four rods long, and were three and one-third links apart. Potato sets were planted one foot apart in the drills, and fifteen pounds of potatoes were used for each plot. A row of potatoes was planted between each two plots, and were left unfertilized. The potatoes were all planted on May 11th, and the fertilizers were sown in drills, after the tubers had been dropped, but before they were covered. Nitrate of soda and muriate of potash were used at the rate of 160 pounds per acre, unleached wood ashes at the rate of 800 pounds per acre, and all the other fertilizers at the rate of 320 pounds per acre. The yields per acre have been estimated form the actual results of the plots.

Fertilizers.	Average percentage of crop marketable, 2 years.	Average weight of 30 best developed potatoes, 2 years.	Yield of whole crop per acre.	
			1895.	Average 4 years, 1892-3-4-5.
		lbs.	bush.	bush.
Royal Canadian	86.35	12.75	107.92	**155.87**
Potato manure	85.07	11.75	100.83	**141.43**
Superphosphate (animal)	85.01	12.75	102.50	**135.12**
Bone and potash	85.42	12.57	119.17	**136.24**
Sure Growth	79.45	12.38	124.58	**133.98**
Superphosphate (mineral)	84.44	12.50	115.42	**130.87**
Reliance	84.53	12.50	101.67	**126.66**
Muriate of potash	86.48	11.63	107.50	**127.23**
Pure Bone Meal	79.38	12.13	87.50	**121.49**
Capelton	80.00	12.07	71.67	**113.45**
Nitrate of soda	73.14	10.94	35.42	**104.27**
Wood ashes	85.26	13.07	94.17	**116 71**
Victor	86.64	12.88	118.33	**119.70**
No fertilizer	85.30	13.13	99.17	**110.45**

From the foregoing table it will be observed that the Royal Canadian fertilizer has given the best yield of potatoes per acre in the average of four years' experiments. Although the Royal Canadian fertilizer did not produce the highest yield per acre in 1895, it was one of the five fertilizers which gave the best results. The Potato fertilizer has given the second highest yield of potatoes per acre in the average of four years, but the same time has given a yield of over fourteen bushels per acre less than the Royal Canadian. The best results during the past year were obtained from the Sure Growth fertilizer, which supplies nitrogen, potash and phosphoric acid, as also does the Royal Canadian and the Potato manure previously mentioned. The unfertilized plot has given an average of over forty-five bushels per acre less than the Royal Canadian fertilizer for the length of time that this experiment has been conducted. Nitrate of soda, Pure Bone Meal, and Sure Growth fertilizers produced the largest average of small potatoes in the results of two years' experiments. The crop of potatoes was increased 98.8 per cent. in 1892, 57.1 per cent in 1893, 17 per cent. in 1894, and 8.8 per cent in 1895, by the application of 320 pounds of the Royal Canadian fertilizer. This fertilizer costs about $38.00 per ton.

Potatoes—Rural Trench System.

The rural trench system has been adopted in the United States, when growing potatoes in competition for large yields. By this method trenches are made from ten to twelve inches in width, and about a foot in depth, by completely removing the soil. The soil is then returned to the trenches from which it was removed and the potatoes are planted in the soil thus returned. A test of this system, in comparison with our usual method of cultivation, was made on duplicate plots in 1894 and on triplicate plots in 1895. Each trench was dug to the depth of one foot, and was made ten inches in width. The rows were four rods long and three feet apart, and the potatoes were planted about four inches below the surface of the soil. Two plots received farmyard manure at the rate of twenty tons per acre. Two plots received potato fertilizer at the rate of one thousand pounds per acre, and two other plots a combination of farmyard manure and potata fertilizer. The manure and fertilizer was mixed through the entire lot of soil, which was removed from and placed back in the trenches. Two plots of trenches were left unfertilized and the remaining two plots were planted according to our ordinary method in planting our varieties.

Fertilizer.	Amount of fertilizer used per acre.	Yield of whole crop per acre.		
		1894.	1895.	Average, 2 years, 1894-95.
		bus.	bus.	bus.
Farmyard manure	20 tons	403 34	337 94	**370.64**
Ordinary method		335.27	367.56	**357.42**
Royal Canadian and Manure	1,000 lbs. R.C. + 20 tons M	360 02	336 11	**348.07**
No fertilizer		312 82	318.39	**315.61**
Royal Canadian fertilizer	1,000 lbs	329.54	300.05	**314.80**

It will be observed from the foregoing table that the largest average yield per acre in 1895, was produced from our ordinary method of cultivation, and in 1894 from farmyard manure used in the trenches. The average results for two years show that the largest yield of potatoes was produced from the farmyard manure, and the lowest from the application of fertilizer under the rural trench system. These results seem a little peculiar, but it might be that all the soil being removed from the trenches in the spring of the year immediately before planting, caused too much of the subsoil to come into contact with the growing potatoes. Had the trenches been made in the autumn of the year better results might have been obtained.

Swede Turnips—Comparative Test of Sixty-eight Varieties.

Varieties of Swede turnips have been grown during the past season to the number of sixty-eight. The seed was secured from seedsmen in England, United States and Canada. Twenty-nine of these varieties have now been grown in our trial grounds for five years in succession; other newer varieties were obtained for the first time in 1892, and others in 1893 1894 and 1895. The soil on which the sixty-eight varieties were grown during the past season was what might be termed an average clay loam. The land grew a crop of winter wheat in 1894, and was manured this spring at the rate of twenty tons of farmyard manure per acre. The land was plowed early in the autumn and again before seeding. Light ridges were made with a double mould board plow at a distance of three and one third links apart. There were three drills of each variety, the drills being four rods in length. Seeding took place on June 19th. Great care was exercised in thinning the roots, which were left at an average of ten links apart in the drill.

Swede Turnips—Comparative Test of 68 Varieties.

Varieties.	Results for 1895.				Average results for number of years grown.		
	Soundness of roots.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
Grown for five years:		tons.	lbs.	tons.	tons.	lbs.	tons.
1 Hartley's Bronze Top	good	7.48	1.40	14.65	6.18	1.91	**21.39**
2 White Swede	medium	7 50	1.55	14.25	6.60	2.25	**20.29**
3 P. W. & Co's. Imperial Prize Purple Top	"	4.48	1.42	13.08	6 24	2.30	**19.89**
4 Our Selected Purple Top	medium to poor.	4.80	1.48	12.75	4.94	2.25	**19.65**
5 Skirving's Swede	medium	5.08	1.46	12.20	5.86	2.16	**19.64**
6 Carter's Imperial Hardy	"	5.65	1.44	12.58	6 04	2.19	**19.56**
7 Carter's Prize Winner	"	4.95	1.27	11.60	5.89	2.13	**19.48**
8 Sharpe's Improved	"	5.65	1.47	15.05	5.07	2.05	**19.41**
9 Knowfield	"	6 78	1.60	16.45	5.34	2.14	**19.15**
10 Sutton's Champion	medium to poor.	5.25	1.62	13.38	5.24	2.23	**19.08**
11 Westbury's Improved	"	4 68	1.61	13.10	6.34	2.15	**19 07**
12 Hazard's Improved	medium	5 01	1.33	11.05	5.33	2.26	**19.05**
13 Bangholm	medium to poor.	5.25	1.51	12 30	5.97	2.16	**18.94**
14 Marshall's Purple Top	medium	4.28	1.43	6.88	5.46	2.28	**18.89**
15 Hall's Westbury	medium to poor.	5.75	1.66	14.10	4.93	2.09	**18.82**
16 Highland Prize Purple Top	medium	7.18	1.59	16.33	6.19	2.10	**18.80**
17 Drummond's Imperial	"	5.40	1.55	14.78	5.70	2.10	**18.49**
18 Green Top	"	5.45	1.37	11.50	6.68	2.11	**18.45**
19 East Lothian	"	5.60	1.38	12 88	5.55	2.08	**18.33**
20 King of Swedes	medium to good	6.20	1.39	13.23	5.69	2.07	**18.30**
21 Laing's Improved	medium to poor.	5.80	1.20	11.13	5.80	1.96	**18.08**
22 Carter's Elephant	medium	7.23	1.64	14.00	5.87	2.12	**17.97**
23 Maston's Purple Top	"	6 05	1.72	15.50	5.48	1.97	**17.73**
24 Marquis of Lorne Purple Top	medium to poor.	6.88	1.71	13.85	5.51	2.06	**17.59**
25 Budlong White	medium	4.25	1.43	14.50	4.22	1.81	**17.45**
26 Royal Norfolk Purple Top	good	6.00	1.11	9.53	4.89	1.97	**17.14**
27 White Sweet Russian	medium	10.13	1.34	12.98	6.39	1.86	**16.93**
28 White Rock	"	5.85	1.39	11.25	4.84	1.84	**16.67**
29 Ashcroft's Purple Top	"	3.33	1.67	7.78	4.67	2.01	**15.66**
Grown for four years:							
30 Queen of Swedes	medium	5.50	1.52	13.88	5 71	2.08	**20.17**
31 Crimson King	"	6.50	1.70	16.45	5.94	2.09	**19.78**
32 Shamrock Swede	"	5.80	1.59	15.40	6.03	2.02	**19.16**
33 Rennie's Prize Purple Top	"	6.40	1.76	15.20	6.06	2.14	**18 90**
34 Laidlaw's Improved	medium to poor.	5.60	1 62	14.95	5.62	1.97	**18.84**
35 Aroostock's Ruta Baga	"	5.88	1.36	12.28	5.93	1.80	**17.61**
Grown for three years:							
36 Kangaroo	medium	6.95	1.84	17.50	6.46	2.31	**22.01**
37 N. B. & G. Co's. Prize Winner	"	6.18	1.65	15.35	6.38	2.18	**20.05**
38 Jarman's Improved King of the West Purple Top	medium to good.	6.63	1.81	16.45	6.49	2.14	**19.63**
39 Scottish Champion	medium	6.25	1.49	14.15	6.50	2.00	**19.40**
40 Jumbo or Monarch	"	7.40	1.74	14.75	6.56	2.11	**19.08**
41 Bloomsdale	medium to good.	5.25	1.33	11.00	6.40	2.02	**19.07**
42 Hurst's Monarch	medium	5.98	1.63	13.03	6.12	2.09	**19.00**
43 Improved Long Island	medium to good.	5.85	1.63	13.18	5.55	2.02	**18.62**
44 Maule's Heavy Cropping	good	6.45	1.52	14.35	6.04	1.99	**18.21**
45 Thorp's Improved Shipping	medium	4.88	1.27	12.05	5.29	1.76	**16.61**
46 White French	"	6.83	1.32	11.05	6.91	1.80	**16.35**

SWEDE TURNIPS—COMPARATIVE TEST OF 68 VARIETIES.—*Continued.*

Varieties.	Results for 1895.				Average results for number of years grown.		
	Soundness of roots.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
Grown for two years:		tons.	lbs.	tons.	tons.	lbs.	tons.
47 Buckbee's Giant	medium	6.15	1.72	15.00	7.85	2.44	**22.98**
48 Halewood's Bronze Top	medium to poor.	4.93	1.56	14.00	5.54	2.08	**19.68**
49 New American Yellow	medium	5.08	1.71	13.00	5.73	2.19	**18.93**
50 Keith's Green Top	"	5.60	1.57	12.70	6.58	2.12	**18.38**
51 Dreer's Improved Purple Top	"	4.53	1.49	13.48	4.77	1.92	**18.37**
52 Crosse's Improved	medium to good.	7.75	1.50	12.75	7.75	1.91	**17.68**
53 Improved American Purple Top.	medium	6.70	1.66	13.75	6.26	2.00	**17.00**
54 Mammoth Russian	"	5.00	1.41	12.70	5.18	1.76	**16.38**
55 Skirving's Liverpool	"	5.50	1.40	10.23	5.68	1.91	**16.29**
56 Burpee's Breadstone	medium to poor.	6.00	1.47	14.08	5.10	1 73	**16.04**
57 American Breadstone	medium	4.08	1.16	9.25	3.84	1.50	**12.80**
58 Sweet German	medium to good.	3.70	1.25	12.10	3.24	1.37	**12.73**
59 Burpee's Improved Purple Top	medium	5.23	1.56	14 05	6.87	1.07	**9.72**
Grown for one year:							
60 Simmer's Champion Purple Top	medium to good.	6.05	1.60	15.90	6.05	1.60	**15.90**
61 White Giant Purple Top	medium	6.03	1.58	15.05	6.03	1.58	**15.05**
62 Pearce's Standard	"	5.60	1.50	14.78	5.60	1.50	**14.78**
63 Fulcaster White Fleshed Purple Top	medium to poor.	6.65	1.63	14.05	6.65	1.63	**14.05**
64 Perfection Purple Top	medium to good.	5.03	1.53	13.88	5.03	1.53	**13.88**
65 Improved White Russian	"	6.15	1.64	13.88	6.15	1.64	**13.88**
66 Mammoth Siberian	medium	5.20	1.51	12.45	5.20	1.51	**12.45**
67 Ferry & Co's. Improved Yellow.	medium to good.	3.90	1.34	11.70	3.90	1.34	**11.70**
68 Waite's Eclipse Hybrid		5.35	1.47	9.58	5.35	1.47	**9.58**

The average yield of the Swedes in 1895 was much lower than the average for the past five years, which was evidently owing to the very dry weather during the growing season. The roots made very poor headway for a considerable length of time.

Hartley's Bronze Top. It will be observed that Hartley's Bronze Top still occupies first place in the average yield per acre of all the varieties that have been grown since 1890. This is a good quality Swede and usually grows quite uniform. In the co-operative experiments over Ontario during the past season Hartley's Bronze Top and Carter's Elephant gave practically the same results, and stood the highest among the Swede turnips which were distributed.

White Swede. The White Swede stands next to Hartley's Bronze Top in the average yield of roots per acre; this variety, however, is quite variable in yield from year to year In 1893, seed of this variety was sent to experimenters, over Ontario, and in the average results of five varieties of turnips on nineteen different farms, it came at the bottom of the list in yield per acre, giving about one hundred and forty bushels per acre less than Hartley's Bronze Top.

Kangaroo. The seed of the Kangaroo variety was obtained in England, and in yield per acre, this variety now occupies first place among the eleven varieties grown for three years, with an average of twenty-two tons per acre. In 1895, this variety stands at the head of the list in yield roots per acre, giving a total amount of seventeen and a half tons.

Buckbee's Giant. For two years in succession, Buckbee's Giant has made a very good record, although in 1895 it was surpassed in yield by ten other varieties.

Swede Turnips—Thinning Plants in the Drill.

An experiment has been conducted for four years in succession, in which Swede turnips have been left unthinned, and have been thinned to four, eight, twelve, sixteen, and twenty inches between the plants in the drill. The experiment was conducted in duplicate during each of the four years. In 1895, the plots were one-hundredth of an acre in size. Carter's Elephant variety was used for the experiment. The soil was an average clay loam, and was manured at the rate of twenty tons per acre in the fall of 1893, since which time it has grown a crop of winter wheat. Slight ridges were made with a double mould-board plow, and the seed was sown on June 20th. The plants were thinned when about two inches high, and were left at the distances required :

Distance between Roots in the drill	Yield of Tops per acre.		Average weight per root.		Yield of roots per acre.	
	1895.	Average 4 years.	1895.	Average 4 years.	1895.	Average 4 years.
	tons.	tons.	lbs.	lbs.	tons.	tons.
Unthinned	4.28	6.50	.27	.32	6.04	11.69
4 inches	3.80	....	.55	..	8.29	. ...
8 do	2.98	5.40	.99	1.49	6.65	17.92
12 do	2.93	5.16	1.40	1.91	6.08	15.92
16 do	2.40	4.16	1.29	2.40	5.43	15.68
20 do	1.88	4.44	1.35	2.63	4.44	13.96

Unfortunately we are unable to give the average results for four years, from the plots which contained the plants that were thinned to a distance of four inches apart. We notice that the lightest average yield was produced from the unthinned plot, and the best from the plot thinned to only eight inches. As the distance between the plants increased, the average yield per acre decreased, but there was an increase in the average weight per root. The yield in 1895 was light, owing to the exceedingly dry weather.

Swede Turnips—Different Distances Between the Drills.

The test was conducted in duplicate in 1892, 1893, 1894, and 1895. The roots were all thinned to a distance of ten inches apart in the row. The preparation of the land, including manuring, etc., was the same as that mentioned in the experiment with thinning plants in the drills. The seeding took place on June 21st.

Distance between drills.	Yield of tops per acre.		Average weight per root.		Yield of roots per acre.	
	1895.	Average 4 years.	1895.	Average 4 years.	1895.	Average 4 years.
	tons.	tons.	lbs.	lbs.	tons.	tons.
20 inches	3.68	5.33	1.10	1.50	9.23	16.90
26 do	2.62	5.18	.98	1.82	5.30	15.56
32 do	2.54	4.90	1.01	1.99	4.74	14.30

It will be seen that the largest average roots were obtained from the drills situated thirty-two inches apart; the second largest from those situated twenty-six inches apart; and the smallest from those only twenty inches apart. The largest average yield per acre, however, was from the drills twenty inches apart; the second largest from those twenty-six inches apart; and the lowest yield per acre from the drills having thirty-two inches between them. The results in this table should be considered in conjunction with those in the last table where the drills were the same distance apart, but there was a difference in the thinning of the plants in the drill.

FALL TURNIPS—COMPARATIVE TEST OF 43 VARIETIES.

Varieties.	Results for 1895.						Average results for number of years grown.		
	Soundness of roots.	Color of flesh.	Color of skin.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
Grown for Five Years:				tons.	lb.	tons.	tons	lb.	tons.
1 Jersey Navet	poor	white	green	5.70	2.21	22.65	6.36	2.59	**23.90**
2 Early American Purple Top	"	"	purple	4.10	1.86	19.55	5.84	2.35	**22.80**
3 Early Purple Top Munich	"	"	"	3.50	1.75	18.75	3.96	2.25	**21.32**
4 Purple Top Mammoth	"	"	deep purple.	4.88	2.15	18.80	6.56	2.43	**21.10**
5 Greystone Improved	medium	"	"	5.50	2.04	19.35	7.55	2.51	**20.73**
6 Red Globe Norfolk	medium-poor	"	"	6.35	1.92	18.70	6.86	2 26	**20.40**
7 Pomeranian White Globe	poor	"	white	5.85	2.13	18.35	7.73	2.24	**20.24**
8 Red Top Strap Leaf	very poor	"	green	4.28	1 65	12.35	4.63	2.10	**19.27**
9 White Stone	poor	"	white	4.75	2 40	18 95	4.70	2.17	**17.75**
10 Orange Jelly	medium	yellow	yellow	4.75	1.79	14 35	4.41	1.88	**15.41**
11 Golden Ball	medium-poor	"	"	3.60	1.71	11.95	5.14	1.76	**14.07**
12 Yellow Aberdeen Purple Top	medium	"	purple	6 60	1.80	16.65	6.20	1.64	**13.83**
13 Yellow Aberdeen Green Top	medium-poor	"	green	6.95	1.78	10.70	5.51	1.64	**12.64**
Grown for Four Years:									
14 Imperial Green Globe	medium-poor	white	green	5.20	2.10	10.50	5.16	1.77	**14.39**
15 Purple Top Hybrid	good	yellow	purple	5.30	1.78	13 83	5.31	1.48	**11.39**
Grown for Three Years:									
16 Cow Horn	medium	white	green	4.30	2.27	12.48	4.99	2.37	**20.79**
17 Green Barrel	"	"	"	6.25	1 78	17.40	6.65	2.11	**20.65**
18 White Flat Dutch Strap Leaf	poor	"	purple	4.00	1.82	18.65	5.63	1.97	**20.21**
19 Jarman's Improved Green Top Yellow Scotch	good	yellow	green	4.95	1.97	15.75	6.54	2.08	**19.34**
20 Jarman's Selected Green Globe	good	white	"	5.95	2 18	23 60	5.24	1.93	**19.06**
21 Yellowstone	very good	yellow	"	3 68	1.99	15.25	4.46	2.06	**18.91**
22 Yellow Montgomery	poor	"	purple	5.55	1.61	15.30	7.66	1.90	**18.82**
23 Early White Model	medium-poor	white	white	5.20	2.13	16.00	4.73	2.06	**18.07**
24 Sutton's Imperial Green Globe	medium-good	"	green	5.00	2.18	20.80	5.01	1.89	**18.05**
25 Extra Early Milan	poor	"	reddish	2.48	1.85	16.15	2.14	1.86	**17.92**
26 Jersey Lily	medium	"	purple	6.65	2.10	11.35	7.75	2.15	**17.17**
27 White Six Weeks	very poor	"	white	4.10	1.83	19.50	4.83	1.82	**17.17**
28 Dales' Hybrid	medium-good	yellow	green	10 20	1.94	12.13	8.29	1.64	**13.86**
29 Amber Globe	good	"	"	4.90	1.93	12.35	5.55	1.70	**13.85**
30 Fosterton Hybrid	good-very good	"	"	6.40	1.88	16.45	6.57	1.51	**13.67**
31 Early Maltese	very poor	"	"	4.45	1.55	12.05	4.01	1.44	**13.24**
32 Carter's Champion Green Top Scotch, or Aberdeen Hybrid	good	"	"	7.63	1.29	12.85	6.38	1.18	**10.50**
33 Seven Top	"	white	white	5.70	.63	6.30	6.80	.78	**7.49**
Grown for Two Years:									
34 White Egg	medium	white	white	4 65	2.10	22.10	8.05	3.00	**29.18**
35 White Lily	"	"	"	4.80	2 03	19.85	7.43	2.32	**22.74**
36 Milk Globe	poor	"	purple	9.25	2.23	21.20	11.75	3.31	**22.35**
37 Early La Crosse	medium-poor	"	"	6.00	2.50	24.45	9.67	2.11	**20.58**
38 All Gold	good	yellow	green	8.25	1.92	15.68	7.75	1.91	**16.64**
39 Orange Sweet	medium	"	greenish-yel	5.75	1.77	10.78	7.40	1.88	**14.97**
40 Small Berlin	good	white	white	.15	.26	2.18	.38	.30	**2.47**
Grown for One Year:									
41 Red Top White Globe	poor-very poor	white	purple	3.86	2.39	24.00	3.86	2.39	**24.00**
42 Our Selected White Globe	"	"	white	10 28	2.35	21.83	10.28	2.35	**21.83**
43 Yellow Globe	good	yellow	green	4.35	1.91	18.38	4.35	1.91	**18.38**

In 1895, forty-three varieties of fall turnips were grown upon our experimental plots; thirteen of this number have now been grown for five years in succession; two, for four years; eighteen, for three years; seven, for two years; and three, for one year. Fall turnips sometimes go under the names of White and Yellow Fleshed turnips, and also under the name of Soft turnips. The land upon which this test was made in 1895, grew a crop of winter wheat in the previous year, and was manured at the rate of twenty tons of farmyard manure per acre in the spring of 1895, before being plowed for the turnips. The plots were one-hundredth of an acre in size. Each plot consisted of three rows fourteen rods in length; the rows were all three and one-third links apart. The seed was sown on small ridges. Seeding of the varieties took place on June 20th. When the plots were about two inches high, they were thinned to a distance of ten inches apart in the drills. At the time of harvest, the number of roots was taken as well as the weights of the roots, and the tops were also all carefully weighed. The yields per acre have been estimated from the actual results of the plots.

The seed of the varieties of fall turnips was principally obtained from England, the United States, and Canada. The yield per acre in 1895 was not quite equal to that of the average of the past five years. A careful study of the foregoing table will enable a person to obtain some useful information in regard to the respective merits of the different varieties under test. Not only are the results given for 1895, but also the average for the number of years that the roots have been grown.

Jersey Navet. The Jersey Navet variety stands at the head of the list in yield of roots per acre among the thirteen varieties grown for five years in succession. It has a white flesh, a green skin, and a top which is rather heavier than the average of all the varieties. This variety is cultivated largely in England for garden purposes; but, in our comparative trials, where the roots are all thinned to an equal distance apart, the Jersey Navet has produced a very excellent yield. In the co-operative experiments over Ontario the Jersey Navet occupied first place in the average yield per acre, among five varieties distributed in 1893 and also in 1894; and stood second in yield per acre in the co-operative tests of 1895. This variety was very highly spoken of by a large number of the experimenters who have given it a practical test.

Early American Purple Top. The Early American Purple Top variety stands second in yield per acre among the thirteen varieties grown for five years, but has given a little over a ton per acre less than the Jersey Navet. The early American Purple Top was also distributed over Ontario in connection with the co-operative work. In the average of eighteen successfully conducted experiments in that year, the Early American Purple Top was surpassed in yield per acre by the Jersey Navet by about two-thirds of a ton.

Greystone. The Greystone variety, which has been grown in Ontario for a number of years, and which is perhaps the best known variety of fall turnips in the Province, stands fifth in yield per acre among the thirteen varieties grown for five years in succession. It has given an average of a little over three tons per acre less than Jersey Navet, and the tops are a little larger than those produced by that variety.

Imperial Green Globe. Among the varieties of fall turnips which grow rapidly and are of a beautiful round shape and smooth skin, the Imperial Green Globe appears to be one of the best. From our knowledge of this variety, it appears to be one which would be well adapted to supply the early market.

Fall Turnips—Thinning Plants in the Drill.

For four years in succession an experiment has been conducted in leaving Swede turnips unthinned, and in thinning the plants to four, eight, twelve, sixteen and twenty inches inches in the drills. The experiment has been conducted in duplicate in each of the four years. The land used for this test in 1895 was manured in the autumn of 1893, when it was sown with winter wheat. The soil was an average clay

loam, and had a gradual slope to the north-east. The plots were exactly one-hundredth of an acre in size, there being six rows, each two rods in length in each plot. The seeding took place on June 20th.

Distance between plants in the drill.	Yield of tops per acre.		Average weight per root.		Yield of roots per acre.	
	1895.	Average 4 years.	1895.	Average 4 years.	1895.	Average 4 years.
	tons.	tons.	lbs.	lbs.	tons.	tons.
Unthinned	4.65	11.59	.42	.33	12.70	15.37
4 inches	3.13	7.71	.76	1.04	14.33	23.88
8 "	3.23	7.23	1.38	1.87	14.68	23.77
12 "	3.70	6.98	1.95	2.68	12.79	22.51
16 "	3.17	6.75	2.14	3.33	11.52	21.77
20 "	3.25	6.26	2.34	3.62	10.63	19.38

It will be observed in the above table that the largest average yield of roots per acre in the tests for four years was from thinning the plants to four inches apart in the drill. As the distances between the drills increased, the average yield of roots per acre decreased, and the average size of the individual roots increased. If we compare the thinnings of four and twenty inches, we find that those thinned to twenty inches apart produced roots which were more than three times the size of those which were thinned to four inches apart; but those which were thinned to four inches produced an average of four and a half tons more than those thinned to twenty inches. It will be noticed that the yield of tops per acre is very large from the unthinned roots. It therefore resolves itself into a question of whether it is desirable to grow a large yield and have small-sized roots, or to grow a smaller yield and have roots of a larger size. This can best be determined by the individual farmer according to his respective needs of land and help.

Fall Turnips—Different Distances Between Drills.

An experiment has been conducted for two years in succession in sowing fall turnips in drills twenty, twenty-six and thirty-two inches apart. There were ten drills in each plot of the different distances mentioned above, and the experiment was conducted in duplicate during each of the years 1894 and 1895. The soil, manuring and cultivation were the same as for the experiment in thinning fall turnips at different distances in the drills as mentioned previously. The seeding took place on the 21st of June. The plants were thinned to a distance of ten inches apart when about three inches in height.

Distance between drills.	Yield of tops per acre.		Average weight per root.		Yield of roots per acre.	
	1895.	Average for years 1894-1895.	1895.	Average for years 1894-1895.	1895.	Average for years 1894-1895.
20 inches	3.76	6.75	1.70	2.07	13.82	22.49
26 "	4.19	6.68	1.55	2.33	10.69	20.96
32 "	3.72	6.78	1.57	2.62	8.85	19.39

The largest average yield of roots per acre was obtained from drills which were twenty inches apart, and the largest average roots were produced upon the drills which were thirty-two inches apart. As the drills increased in distance apart, the yield of roots per acre showed a corresponding decrease, but the comparative size of the roots showed a corresponding increase.

Sowing Turnips and Rape Seed at Different Depths.

An experiment was conducted in 1895, in which both turnip and rape seed were sown one, two, three and four inches deep. Both experiments were conducted on duplicate plots. Each plot consisted of one row, four rods in length. An exact number of seeds was used in every instance, and they were sown at such distances in the row as it was desirable to have the roots.

Depth of planting seed.	Yield of crop per acre.	
	Swede turnips.	Rape.
	tons.	tons.
1 inch deep	10.7	19.4
2 inches deep	9.9	14.4
3 inches deep	4.5	14.6
4 inches deep	1.7	10.5

The above table shows the advantage of sowing the seeds but one inch in depth, as compared with sowing two, three and four inches deep. The principal difference in the yield per acre seemed to be produced by the difference in the germination of the seeds. That which was sown one inch deep germinated better than that which was sown deeper.

Mangels—Comparative Test of 55 Varieties.

In 1895 there were fifty-five varieties of mangels grown on plots one-hundredth of an acre in size Of this number twenty-eight have been grown for five years in succession, seven for four years, twelve for three years, six for two years, and two for one year. The land on which the mangel seed was sown was quite similar to that used for the carrots, and was considerably lower in aspect than that used for the Swede and fall varieties of turnips. The soil was plowed in the autumn, and received a coating of twenty tons of farmyard manure per acre in the spring before the mangels were sown. The seeding of the mangels took place on the 30th of April, and the germination was very good indeed. The young plants were about one and a half inches high at the time of the severe frosts in the early part of May. The crop was completely frozen off, and the varieties were all sown a second time about the middle of May. The plants were thinned to ten inches apart in the drill.

The yield of mangels during the past season was a little larger than the average for the past five years, the highest yield per acre being nearly forty-one tons and the lowest six and a half tons. The average weight per root in 1895 was a little over three and a half pounds, and the smallest less than two-thirds of a pound. There were in all about twenty varieties of the long red roots, all of which were somewhat similar to one another in general characteristics.

Evans' Improved Mammoth Saw Log. The Evans' Improved Saw Log variety of mangels now heads the list in yield per acre and among the twenty-eight varieties grown for five years in succession. Not only has this variety given a large average yield of roots per acre, but it will be noticed that the yield in 1895 was very high. The plot was admired by many. The roots were quite uniform in size, all being large. In the co-operative experiments over Ontario in 1895, the Evans' Improved Mammoth Saw Log mangel was one of the five varieties under test. In average results of the fifteen successfully conducted tests during the past year, the Mammoth Saw Log gave the largest yield of roots per acre.

Improved Mammoth Long Red. This variety stands second in yield among those grown for five years, but it has given an average of nearly twenty-six bushels per acre less than the Evans' Improved Mammoth Saw Log during the number of years that both of these varieties have been tested. It was also one of the five varieties tested over Ontario in 1895, and came second in point of yield in the average results. It gave about twenty six bushels per acre less than the Improved Mammoth Saw Log in the average of these co-operative tests.

Mangels—Comparative Test of 55 Varieties.

Varieties.	Color of roots.	Results for 1895.				Average results for number of years grown.		
		Average length of root.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
Grown for Five Years:		inches	tons.	lbs.	tons.	tons.	lbs.	tons.
1. Evans' Improved Mammoth Saw Log	Red....	16 30	8.61	3.57	40 95	4.96	2.45	**26.50**
2. Improved Mammoth Long Red....	"	14.00	6.50	2.92	32.90	4.49	2.25	**24.76**
3. Carter's Champion Yellow Intermediate	Yellow.	9.90	8.25	2.76	31.00	3.54	2.28	**24.43**
4. Elvetham Long Red	Red....	13.80	5.45	2.62	29.65	4.66	2.00	**23.39**
5. Steele Bros. Long Red Selected....	"	14.30	5 10	2.41	27.30	4 17	2.15	**23.19**
6. Norbitan Giant	"	14 30	5.45	2.66	29.90	4.28	2.17	**23.08**
7. Carter's Mammoth Long Red.....	"	13.60	5.63	2.32	24.15	4.44	1.99	**21.45**
8. Yellow Obendorf.....	Yellow.	11.50	3.70	2.41	27.30	3.30	1.87	**21.16**
9. Eiffel Tower....	Red....	12.30	6.48	1.85	20.30	3.74	1.93	**20.50**
10. Mammoth Red Intermediate	"	11.10	2.68	1.99	22.23	3.24	1.85	**20.50**
11. May's Mammoth Long Red.....	"	12.80	4.40	2.32	26.05	4.17	1.81	**20.14**
12. New Monarch	"	13 00	4.13	2.08	23.10	3.53	1.78	**20.08**
13. Colossal Long Red.....	"	13 30	3.73	2.05	22.43	3.58	1.85	**19.94**
14. Giant Holstein.....	"	13.20	4.10	2.15	24.35	3.76	1.85	**19.88**
15. Chirk Castle.....	"	13.40	4.05	2.12	23.55	3.16	1.71	**19.03**
16. Oblong Giant Yellow.....	Yellow.	11.20	3.00	1.54	16.80	2.48	1.75	**18.20**
17. Long Oxhorn	Red....	13.60	3.95	1.89	20.35	3.43	1.69	**17.50**
18. Yellow Oval-Shaped Giant	Yellow.	10.00	2.40	1.88	21 20	1.94	1.62	**17.28**
19. Carter's Warden Orange	"	7.80	1.90	1.70	19.78	2.88	1.52	**16.55**
20. Mammoth Golden Giant	"	9.50	1.85	1.53	17.18	2.78	1.51	**15.72**
21. Yellow Globe	"	6.80	1.60	1.44	16 75	2.67	1.78	**15.26**
22. Red Globe	Red....	6.10	2 15	1.53	17.20	2.37	1.47	**15.18**
23. Golden Tankard	Yellow.	7 90	1.83	1.36	15.10	1.93	1.36	**14.44**
24. Clark's Devon Orange Globe	"	5.80	1.78	1.72	15.25	1.90	1.41	**14.34**
25. Fisher Hobb's Orange Globe	"	6.20	2.38	1.32	12.18	1.92	1.36	**13.67**
26. Long Yellow	"	12.40	1.43	2.60	9 75	2.09	1.70	**12.97**
27. Oblong Giant Red	Red....	10.30	1.50	1 50	10.10	1.80	1.73	**12.53**
28. Kinver Yellow Globe	Yellow.	7.10	3.25	.62	6.50	2.01	1.20	**12.40**
Grown for Four Years:								
29. Sutton's Mammoth Long Red.....	Red....	11.50	2.00	1.16	13.45	3 33	1.46	**15.24**
30. Canadian Giant	"	11.60	2.13	1.15	13.00	2.87	1.27	**13.16**
31. Berkshire Prize Yellow Globe.....	Yellow.	6.30	1.43	1.31	14.08	1.55	1.25	**12.72**
32. Gate Post	Red....	11.40	2 60	1.16	12.48	2.65	1.26	**12.54**
33. Beck's Champion Globe	Yellow.	5.90	1.35	1.05	11.85	2.02	1.22	**12.41**
34. Sutton's Golden Tankard	"	6.90	1.40	1.01	11.10	1.95	1.17	**12.02**
35. Sutton's Yellow Intermediate.....	"	7.40	1.25	1.10	13.00	1.52	1.12	**11.61**
Grown for Three Years:								
36. Giant Yellow Intermediate.....	Yellow.	10.80	2.70	1.55	17.05	2.53	1 54	**15.84**
37. Yellow Leviathan	"	11.10	2.53	1.51	15.95	2.42	1 52	**15.62**
38. English Prize	Red....	12.20	3.50	1 62	18.10	2.88	1.42	**14.83**
39. New Eschendorf.....	Yellow.	6 80	2.03	1.36	15.43	1.89	1.39	**14.46**
40. Yellow Ovoid	"	8.70	2.53	1.38	15.20	2.49	1.36	**14.15**
41. Ward's Oval	"	10.30	2.63	1.46	16.75	1.99	1.27	**13.64**
42. Sutton's Yellow Globe	"	5.70	1.40	1.25	13.75	1.65	1.63	**13.62**
43. Jarman's Giant Long Red	Red....	11.40	2.70	1.05	10 75	2.90	1.27	**13.16**
44. Olive-Shaped Red	"	6.70	2.15	1.41	14.10	2 06	1.26	**12.86**
45. Jarman's Giant Intermediate	Yellow.	7.00	1.20	1.01	10.63	1.21	1.19	**11.81**
46. Jarman's Selected Golden Tankard.	"	5 50	1.40	1.09	11.20	1.67	1.41	**11.35**
47. Jarman's Model Yellow Globe	"	7.20	1.60	.97	10.18	1.65	1.23	**10.72**
Grown for Two Years:								
48. Thorp's Own Yard Long	Red....	12 20	3 40	1.46	14.55	4.18	1.69	**17.48**
49. Jumbo.....	"	11.40	3.10	1.42	15.83	2.80	1.60	**16.37**
50. Dignity	"	12.70	3.55	1.42	16.23	3.15	1.44	**14.67**
51. Carter's Warden Prize Yellow Globe	Yellow.	7.00	1.55	1.27	13.60	2.03	1.38	**14.05**
52. Thorp's Own Champion Yellow Intermediate	"	7.20	2.45	1.29	12.93	1.90	1.40	**13.87**
53. Webb's New Kinver Yellow Globe.	"	6.70	1.30	1.17	12 88	1.23	1.25	**13.19**
Grown for One Year:								
54. Effurt Model.....	Yellow.	10 00	2.80	1.30	14.90	2 80	1.30	**14.90**
55. Long White	White..	16.10	3.13	1.27	13.93	3.13	1.27	**13.93**

Mangels—Different Distances Between the Drills.

This experiment has now been conducted for four years in succession, and it has been carried on in duplicate each year. The mangel seed was sown on May 2nd, and the plants were not large enough to be destroyed by the severe frosts. The land received a dressing of twenty tons of farmyard manure per acre in the spring of the present year. The plants were thinned to a distance of ten inches apart in the drill.

Distance between drills.	Yield of tops per acre.		Average weight per root.		Yield of roots per acre.	
	1895.	Average, 4 years.	1895.	Average, 4 years.	1895.	Average, 4 years.
	tons.	tons.	lbs.	lbs.	tons.	tons.
20 inches	2.18	3.78	1.35	1.71	8.85	20.43
26 inches	1.98	3.91	1.45	1.98	7.95	18.68
32 inches	1.98	4.05	2.25	2.40	9.06	18.11

As in the case of the Swede turnips and the fall turnips, we notice that the largest average yield of roots per acre is from the closest drills, and the smallest yield is from the drills widest apart. The results for 1895, however, vary slightly from this general rule, as the largest yield is from the mangels on the drills thirty-two inches apart.

Carrots—Comparative Test of 45 Varieties.

Forty-five varieties of carrots were tested in the trial grounds during the summer of 1895. Twenty-three of this number have been grown for four years in succession, eleven for three years, nine for two years, and three for one year. The yield of roots per acre was not so high in 1895 as in the average of the past four years. The plots on which the carrots were grown were each ten links wide by one hundred links long, making each plot one-hundredth of an acre in size. The land was quite uniform throughout. The seed was sown in drills nearly twenty-seven inches apart on April 30th. When the plants were about three inches in height they were thinned to an average of four inches apart. The thinning was done very carefully, the number of roots left being counted in every instance.

An average yield per acre for four years of nearly thirty tons of carrots is a very good record ; this has been the yield of the best varieties. It will be noticed that the varieties which made the best records in the average of four years are all white cone-shaped carrots, which are somewhat similar in size, shape and general appearance.

Pearce's Improved Half-Long. This variety has given the best average yield of roots per acre among twenty-three varieties grown for four years in succession. During the past season it was surpassed in yield per acre by twelve other varieties. It is a fine-shaped root, and one easily removed from the ground (which we consider a very great advantage) as compared with the Large White Belgian and other long, slender kinds.

Steel Brothers' Short White. This variety resembles very closely the one already described, and in the average of four years has given a little less total yield of crop per acre. The individual roots, however, have been a little larger in average size than those of Pearce's Improved Half-Long variety. In the co-operative experiments over Ontario, the Improved Short White has been distributed with four other varieties for four years in succession, and has given the largest average yield of roots per acre during each of these four years.

Guerande. The Guerande variety is one that is often used for garden purposes. It is short and very thick, and is exceedingly easy to remove from the land. On the whole, it has made a very good showing, but when compared with the first two varieties on the list, it has given an average of nearly ten bushels per acre less than these varieties.

Mammoth Intermediate Smooth. The Mammoth Intermediate Smooth, has been grown for two years in our trial grounds and has made a very fine record indeed. During 1895, it produced the largest yield of roots of any of the varieties under experiment.

Test of 45 Varieties of Carrots.

Varieties.	Color of roots.	Shape of roots.	Results for 1895.			Average results for number of years grown.		
			Yield of tops per acre.	Average weight per root.	Yield of roots per acre.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
Grown for Four Years:			tons.	ozs.	tons.	tons.	ozs.	tons.
1 Pearce's Improved Half-Long	white	cone	3.45	11.27	17.08	7.82	15.07	**29.49**
2 Steele Bros.' Improved Short White	white	cone	4.55	10.98	17.15	7.78	15.11	**28.74**
3 White Green Top Orthe	white	cone	3.95	12.05	15.25	6.87	14.50	**27.21**
4 Mastadon	white	cone	4.10	11.92	18.25	6.64	13.82	**26.90**
5 Large White Vosges	white	cone	3.65	11.40	17.45	6.11	13.40	**26.06**
6 Simmers' Short White Vosges	white	cone	3.65	10.80	16.93	5.69	12.65	**24.42**
7 Sutton's Yellow Intermediate	yellow	cone	4.40	10.52	14.80	6.09	12.49	**23.26**
8 P. W. & Co.'s Improved, Giant White Wiltshire	white	cone	2.35	11.43	18.75	6.41	12.84	**22.85**
9 Large White Belgian	white	long	2.75	9.26	13.75	6.09	11.69	**22.48**
10 Danver's Orange	orange	cone	2.10	7.87	12.25	4.20	10.28	**21.48**
11 Giant Wiltshire	white	long	3.05	9.06	14.15	6.77	10.40	**20.80**
12 Mitchell's Perfected	red	m'dium long	2.85	10.32	15.45	3.77	10.22	**19.92**
13 Guerande	red	short	2.20	8.90	14.75	3.36	8.28	**19.81**
14 Carter's Orange Giant	orange	long	3.40	13.29	18.75	4.27	12.25	**18.78**
15 French Intermediate	red	m'dium long	2.70	7.17	13.00	4.37	8.21	**18.10**
16 Scarlet Intermediate	red	m'dium long	2.80	9.07	13.75	3.82	8.93	**17.72**
17 Half-Long Stump-Rooted	red	m'dium long	1.80	7.38	13.50	2.63	7.97	**17.18**
18 James' Scarlet Intermediate	scarlet	m'dium long	2.25	7.54	11.55	3.39	7.83	**16.33**
19 Long Red Surrey	yellow	long	3.15	8.52	13.45	4.07	7.85	**14.97**
20 Yellow Belgian	yellow	long	2.60	7.75	11.50	4.59	8.28	**14.92**
21 Sutton's Improved Intermediate	red	long	.70	4.00	2.50	2.94	7.26	**14.52**
22 Long Orange	orange	long	3.95	8.00	11.75	5.78	7.20	**14.05**
23 Improved Large Long Red Altringham	red	long	2.05	6.08	8.40	4.20	6.93	**12.97**
Grown for Three Years:								
24 Rubicon Half-Long	red	short	1.85	8.87	14.55	3.46	8.63	**16.93**
25 Long Red St. Valery	red	long	2.55	9.45	14.85	3.45	8.90	**16.87**
26 Nichol's Improved Long Orange	red	long	2.90	9 00	12.80	3.76	9.00	**16.85**
27 Nante's Half-Long Stump-Rooted	red	half-long	1.65	7.76	14.40	3.18	8.71	**15.93**
28 Chantenay	red	half-long	2.35	10.54	16.80	2.67	9.25	**15.76**
29 Half-Long Scarlet	red	half-long	2.05	7.83	13.45	3.22	7.52	**15.65**
30 Red Parisian Forcing	red	round	1.40	6.57	11.90	1.96	6.40	**13.43**
31 New Long Red Coreless	red	long	1.25	5.98	9.35	2.29	6.41	**12.71**
32 Small French Forcing	red	short	1.85	6.62	10.55	1.48	5.63	**10.50**
33 Jarman's Scarlet Green Top	red	cone	.75	13.47	2.53	1.78	11.97	**6.89**
Grown for Two Years:								
34 Mammoth Intermediate Smooth	white	cone	5.00	16.65	24.30	5.75	16.86	**26.90**
35 Iverson's Champion White	white	cone	5.55	17.43	21.45	6.18	17.34	**25 65**
36 Simmers' Giant White	white	cone	4.35	13.95	21.28	4.68	13.90	**23.27**
37 Improved White Belgian	white	long	3.80	10.96	19.15	4.68	12.35	**21.60**
38 Yellow Intermediate	yellow	long	5.50	13.53	20.50	7.52	14.77	**19.63**
39 Midsummer	red	m'dium long	2.65	11.03	18.40	2.93	10.33	**18.77**
40 Victoria	red	long	3.25	8 66	14.15	3.58	9.17	**16.30**
41 Yellow Giant	yellow	long	4.10	10 34	15.35	3.95	10.61	**16.00**
Early Half-Long Carentian	scarlet	half long	.85	4.64	8.70	1.38	5.95	**11.44**
Grown for One Year:								
43 Thorpe's Own Short White	white	half long	2.70	9.58	17.28	2.70	9.58	**17.28**
44 Henderson's Intermediate	red	cone	3.75	10.13	16.15	3.75	10.13	**16.15**
45 Very Heavy Cropper	white	long	2.75	10.80	13.50	2.75	10.80	**13.50**

Carrots—Different Distances Between the Drills.

The seed was sown on May 2nd, and the plants when about two inches high were thinned to a distance of ten inches apart.

Distance between drills.	Yield of tops per acre.		Average weight per root.		Yield of roots per acre.	
	1895.	Average, four years.	1895.	Average, four years.	1895.	Average, four years.
	tons.	tons.	lbs.	lbs.	tons.	tons.
20 inches	4.87	6.47	.71	76	24.17	28.73
26 "	4.81	6.27	.86	.89	24.73	27.24
32 "	3.89	5.59	.95	.94	20.48	22.77

It will be seen that there is a difference of about six tons per acre in favor of the drills twenty inches apart, as compared with those thirty-two inches apart. The weight per average root, however, on the drills thirty-two inches apart was about one-quarter larger than those on the drills twenty inches apart.

Sugar Beets—Comparative Test of 13 Varieties.

Sugar beets are grown to a limited extent for feeding purposes, and it is principally as a stock food that we have grown thirteen varieties on the trial grounds during the past year. Of these thirteen varieties, nine have been grown for five years in succession, three for two years and one for one year. The soil on which these experiments were conducted during the past season, was what might be termed an average clay loam, which was manured in the spring of 1895 with well rotted barn-yard manure, at the rate of twenty tons per acre. The land was slightly ridged with a double mould-board plow, the drills being made three and one-third links apart. Three rows, each four rods long, were devoted to each variety. The seeding took place on May 1st, but, owing to the severe frosts during the first half of May, the young plants were frozen off so badly that the seed had to be sown the second time, which was done during the latter part of May. Plants were thinned to ten inches apart in the drill.

Varieties.	Color of roots.	Results for 1895.			Average results for number of years grown.		
		Yield of tops per acre.	Average weight per root.	Yield of roots per acre.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
		tons.	lbs.	tons.	tons.	lbs.	tons.
Grown for four years:							
1 White Silesian	white	4.05	1.34	15.19	5.43	1.54	**17.97**
2 Red Top	reddish	2.75	1.37	15.40	4.10	1.49	**17.46**
3 Lane's Improved	white	3.60	1.38	16.20	2.69	1.40	**16.74**
4 White French	"	3.15	1.17	11.08	4.38	1.43	**16.29**
5 Austria Electorial Wohanka	"	3.45	1.35	15.80	5.12	1.29	**15.40**
6 Champion	reddish	2.90	1.06	11.15	3.99	1.28	**14.77**
7 Kleinwanzelben	white	3.70	1.17	12.58	5.07	1.22	**14.01**
8 Red Skinned	reddish	2.00	1.05	12.35	3.25	1.07	**12.43**
9 Improved Imperial	white	3.60	1.06	12.43	3.73	1.74	**10.58**
Grown for two years:							
10 Jersey	slightly red	1.95	1.29	15.13	4.25	1.44	**19.13**
11 New Danish Island	"	1.73	1.11	13.00	2.93	1.48	**18.73**
12 French Yellow	yellowish	3.10	1.15	13.20	3.48	1.22	**16.00**
Grown for one year:							
13 Green Top White	white	3.35	1.20	14.00	3.35	1.20	**14.00**

It will be observed that the White Silesian heads the list in yield of roots per acre, among the varieties grown for four years. It was, however, slightly surpassed in yield per acre by three other varieties during the past year. The White Silesian sugar beet

was sent out with four varieties of mangels in a comparative test over Ontario in connection with the system of co-operative experimental work, and in the average of fifteen successfully conducted experiments over Ontario during the past season, it gave a smaller yield of roots per acre than either of the long, medium, or Globe varieties of mangels. It surpassed the Globe variety, however, in 1894.

Parsnips—Comparative Test of 4 Varieties.

Four varieties were obtained during the present year and grown side by side in our experimental grounds to find out which variety would be likely to give the best yield, and also to obtain a comparison between the yield of parsnips and that of other roots, when grown under similar conditions. The remarks regarding the soil, conditions, etc., are omitted at this time, as the conditions were similar to those for sugar beets.

Varieties.	Average weight per root.	Yield per acre.	
		Tops, 1895.	Roots, 1895.
	lbs.	tons.	tons.
Improved Long Smooth	.55	3.25	13.18
Improved Half-Long	.55	2.85	13.18
New Ideal Hollow Crown	.47	2.70	11.00
Magnum Bonum	.42	2.20	9 35

It will be observed that the two varieties standing at the head of the list gave exactly the same yields of roots per acre. Each of these varieties gave an average of nearly four tons per acre more than the Magnum Bonum. The roots of all four varieties were very nice and uniform.

SILAGE AND FODDER CROPS.

A considerable amount of experimental work has been devoted to the testing of various kinds of silage and fodder crops during the past few years. They include tests with fodder corn, millet, sunflowers, rape, grasses, clovers, sugar cane, etc.

Corn for Fodder, Silage and Grain—Comparative Test of 131 Varieties.

During the past season one hundred and thirty-one varieties of corn have been grown in our experimental field. They have been tested in such a way that the reports should prove of great value to those who are desirous of obtaining information regarding leading varieties of corn for silage, dry fodder or grain. Of all the varieties now under investigation, fifty three have been grown for five years in succession, eight for four years, fifteen for three years, thirty for two years and twenty-five for one year. The seed of the majority of the varieties was obtained in the United States, while that of a number of the earlier kinds was obtained in Canada. By the suggestion and help of Prof. James, Deputy Minister of Agriculture for Ontario, a few of the very early varieties of corn, which have been grown for a number of years by the Indians in the north-western part of Ontario, were secured. The object of this is to obtain reliable information regarding the value and the characteristics of these varieties, and also, by experimental work, to find out whether there are any other varieties which will surpass them in the northern parts of this Province. It is the intention to endeavor, through selection and hybridization, to obtain as valuable varieties as possible for the northern sections.

The land on which the different varieties of corn were grown in 1895 produced a crop of oats the previous year, aud a crop of potatoes in 1893. No manure was applied to the land since the spring of 1893. The corn, therefore, was the third crop on the land after the application of the manure. The land was what might be termed an average clay loam, and was plowed in the autumn of 1894. In the spring of the present year it was thoroughly cultivated, before the corn was planted. All the varieties grown during the present year were tested on duplicate plots. The corn was planted in hills five links (39.6 ins.) apart both ways. Four plants were allowed to remain in each hill. The planting of all the varieties took place on May 23rd. The yields per acre have been estimated from the actual yields of the plots.

TEST OF 131 VARIETIES OF CORN FOR SILAGE FODDER OR GRAIN.

Varieties.	Kinds of corn.	Average results for 1895.					Average results for number of years grown.	
		Condition of grain when harvested.	Height of plants.	Number of ears per plot.	Yield of ears per acre.	Yield of whole crop per acre.	Yield of ears per acre.	Yield of whole crop per acre.
Grown for five years:			ins.		tons.	tons.	tons.	tons.
1 Chester County Mammoth	White Dent.....	Early Milk	109	130	1.72	21.9	1.30	21.42
2 Brazilian Flour	"	Water	102	99	.62	21.1	.45	21.07
3 Thoroughbred White Flint ...	"	Milk	97	133	2.56	21.9	1.94	20.87
4 Mammoth White Surprise	"	Early Milk	112	97	1.15	20.9	.91	20.59
5 Blunt's Prolific	"	"	113	104	1.23	21.3	1.23	20.43
6 Cloud's Early Yellow	Yellow Dent.....	Dough	101	116	2.96	20.7	3 31	20.23
7 Mastadon Dent	"	"	103	126	3.18	20.0	3.00	20.0
8 Virginia Horsetooth	White Dent	Milk	108	91	.84	20.5	.91	19.41
9 Mammoth Sweet Fodder	Sweet.....	Dough	84	145	2.65	19.6	2.50	19.20
10 Giant Prolific Sweet Ensilage .	White Dent.....	"	97	133	2.65	19.2	2.29	18.92
11 Mammoth White Cob Ensilage	"	Early Milk	105	93	1.34	19.7	1.63	18.87
12 Red Cob Ensilage	"	Milk	104	126	1.83	19.7	1.83	18.72
13 Golden Beauty	Yellow Dent.....	Late Milk	105	103	1.59	18.5	2.22	18.70
14 Mammoth Southern Sweet ..	Sweet.....	"	103	130	1.71	19.2	1.61	18.66
15 Sheep's Tooth	White Dent.....	"	101	110	1.95	20.5	1.63	18.47
16 Hickory King	"	Milk	102	88	1.16	17.6	1.02	18.35
17 Salzer's Sup. Fodder Ensilage .	"	"	104	91	1.29	19.6	1.69	18.20
18 Mammoth Cuban	Yellow Dent.....	Firm Dough	96	135	3.53	18.3	3.57	18.04
19 Improved Leaming	"	"	86	156	2 81	13.6	3.06	17.87
20 Horsetooth	"	Dough	97	130	2 39	18.6	2.91	17.73
21 Egyptian Sweet	Sweet	"	88	158	2.56	18.6	2.07	17.45
22 Centennial White	White Dent.....	"	96	....	1.86	14.0	2.90	17.28
23 Salzer's North Dakota	White Flint.....	Ripe	88	173	3.26	16 9	2.04	16.98
24 Hickox Sweet	Sweet.....	Dough	85	136	2.83	17.7	2.67	16.85
25 Evergreen Sweet	"	"	78	184	3.00	17.4	2.48	16.8
26 Tuscorora	White Flint.....	Firm Dough	82	158	3.89	18.0	3.19	16.62
27 Sweet Fodder	Sweet.....	Dough	88	144	3.09	19.4	1.69	16.58
28 Salzer's South Dakota	Yellow Flint	Firm Dough	80	142	2.44	16.2	2.87	16.41
29 Wisconsin Earliest White Dent	White Dent.....	"	90	146	4.08	15.6	3.78	15.85
30 Clark's County Champion	"	"	93	142	3.29	16.3	2.83	15.77
31 Stowell's Evergreen Sweet	Sweet.....	Dough	81	169	3.10	18.0	2.31	15.77
32 Large White Flint	White Flint.....	Firm Dough	84	152	3.49	16.2	3.22	15.61
33 Old Colony	Sweet.....	"	81	178	3.88	16.1	2.89	15.28
34 Late Mammoth Sweet	"	Dough	82	131	2.87	17.8	2.33	15.20
35 Pride of the North	Yellow Dent.....	Firm Dough	89	125	2.87	16.3	2 94	14.89
36 Compton's Early	Yellow Flint ...	Ripe	84	145	3.20	14.3	3.33	14.83
37 Longfellow	"	"	81	167	2.78	13.8	2.90	14.61
38 Early Butler	Yellow Dent	"	85	131	2.86	13.2	3.05	14.49
39 Angel of Midnight	Yellow Flint	"	81	179	2.90	13.3	2.86	14.39
40 100-Day Corn	"	"	79	148	2 86	15.2	2.94	13.72
41 Golden Dent	Yellow Dent	Firm Dough	90	131	2.96	14.7	2.86	13.47
42 Early White Flint	White Flint.....	Ripe	81	152	3.21	12.4	3 04	13.13
43 Wauskakum	Yellow Flint	"	76	154	2.89	11.3	2 91	12.97
44 Canada Yellow	"	"	77	157	3.19	13.4	3.00	12.94
45 Early Adams or Burlington ..	White Dent.....	Firm Dough	84	130	2.38	12.8	2.66	12.92
46 Dakota Dent	Yellow Dent.....	Ripe	83	142	2.79	12.1	3.08	12.91
47 Queen of the North	"	"	81	134	2.56	11.7	2.90	12.74
48 Self Husking	Reddish Flint....	"	69	140	2.88	10.5	2.60	12.31
49 Minnesota King	Yellow Dent.....	"	75	159	3.23	11.7	3.12	12.28
50 Pearce's Prolific	Yellow Flint	"	73	148	2 98	14.7	2.34	12.24
51 King of the Earlies	Yellow Dent.....	Firm Dough	81	148	2.72	13.7	2.85	12.15
52 Crosby	Sweet.....	Dough	68	207	3.30	13.3	2.74	11.74
53 Rideout or Mercier	Yellow Flint	Ripe	71	137	2.63	12.4	2.85	11.09

List of 131 Varieties of Corn for Silage Fodder or Grain.—*Continued.*

Varieties.	Kinds of corn.	Average results for 1895.					Average results for number of years grown.	
		Condition of grain when harvested.	Height of plants.	Number of ears per plot.	Yield of ears per acre.	Yield of whole crop per acre.	Yield of ears per acre.	Yield of whole crop per acre.
Grown for four years:			ins.		tons.	tons.	tons.	tons.
54 Giant Beauty	Yellow Dent	Late Milk	96	127	3.53	20.9	3.37	**20.86**
55 Dr. Woodhull	" "	"	95	122	2.97	19.8	2.99	**20.37**
56 N. B. & G. Co's Giant Fodder	White Dent	Milk	104	124	2.29	21.8	1.74	**20.24**
57 New Leaming	Yellow Dent	Firm Dough	92	145	3.76	18.6	3.27	**18.07**
58 Pride of Kansas	" "	Milk	97	47	1.09	15.5	1.74	**17.77**
59 True Leaming	" "	Dough	91	133	3.05	16.6	3.38	**17.55**
60 Wilson's White Prolific	White Dent	"	93	145	3.41	18.0	3 07	**16.92**
61 Silver Flint	White Flint	Ripe	65	148	3.09	12.0	3.14	**12.45**
Grown for three years:								
62 Peach Blossom Mam. Field	Pinkish Dent	Dough	100	84	2 51	18.4	2.78	**20.20**
63 Boone Co. White	White Dent	"	101	125	2.91	19.3	2 60	**19.50**
64 Champion White Pearl	" "	"	91	133	3.09	19.3	3.29	**19.34**
65 Legal Tender	Yellow Dent	"	104	128	2.93	19.5	2.77	**19.27**
66 Kansas King	White Dent	Late Milk	102	122	1.67	19.1	1.72	**19.22**
67 Giant White Southern	" "	Dough	99	131	3.03	18.8	2.52	**18.93**
68 Big Buckeye	Yellow Dent	"	108	126	3.02	18.5	2.75	**18.47**
69 Elephant Fodder	" "	"	104	127	3.13	17.8	3.04	**18.17**
70 Iowa Gold Mine	" "	Firm Dough	98	139	3.17	17.0	2.99	**16.73**
71 Queen of the Field	" "	"	98	125	3.29	15.1	3.67	**16.45**
72 N. B. & G. Co's Rustler White Dent	White Dent	"	87	154	3.66	15.2	3.80	**15.54**
73 Red Blazed	Reddish Dent	Ripe	77	152	2.84	13.3	3.33	**15.38**
74 Farmer's Favourite	Yellow Dent	Dough	97	101	2.57	18.4	2.08	**13.90**
75 Dakota Queen	" "	Ripe	88	147	2.89	12.4	3.39	**13.24**
76 Extra Early Huron Dent	" "	"	92	160	3.20	12.4	3.28	**13.01**
Grown for two years:								
77 Nebraska White Prize	White Dent	Dough	89	135	2.94	18.1	2.95	**18.73**
78 Perfect Mammoth Ensilage	" "	"	99	128	2.53	18.4	2.76	**18.53**
79 Paragon White Ensilage	" "	Late Milk	101	100	1.29	18.3	2.10	**18.07**
80 Riley's Favourite	" "	Dough	96	118	2.09	16.2	2.74	**17.30**
81 High Mixed	Yellow Dent	"	95	112	2.53	16.4	3.14	**17.00**
82 Golden Superb	" "	"	94	101	1.92	17.2	2.50	**16.73**
83 Red Blaze	Reddish Flint	Ripe	85	157	3.34	14.3	3.41	**16.69**
84 White Prolific	White Dent	Dough	94	116	2.14	15.7	2.68	**16.53**
85 Champaign Co. Prolific	Yellow Dent	"	89	100	1.78	16.3	2.07	**16.52**
86 Yellow Western Horsetooth	" "	"	92	116	2.21	16.2	2.70	**16.25**
87 Early California	" "	"	91	113	2.18	16.2	2.40	**16.15**
88 Waterloo Extra Early Dent	" "	"	90	101	1.86	15 7	2 31	**16.10**
89 90-Days Leaming	" "	Firm Dough	87	120	2.38	15.4	2.76	**15.94**
90 Salzer's Early Giant White Dent	White Dent	"	91	139	3.30	14.2	3.83	**15.68**
91 Early White Cap Dent	" "	"	92	104	2.09	13.7	2 84	**15.28**
92 Nebraska Mammoth Red	Red Dent	"	92	120	2.53	14.0	2.95	**15.13**
93 Canadian Dent	Yellow Dent	Ripe	88	125	2.47	12.7	2 87	**15.00**
94 Sangford	White Flint	Firm Dough	79	141	2.54	15.3	2.65	**14.65**
95 Wisconsin White Flint	" "	"	81	156	2.82	15.4	2 67	**14.43**
96 King Philip	Reddish Flint	Ripe	81	151	2.81	10.4	3.45	**13.47**
97 North Star Yellow Dent	Yellow Dent	"	86	131	2 83	12.0	3.26	**13.47**
98 Hutt	" "	"	77	149	3.53	12.7	3.68	**13.38**
99 Pride of Canada	Yellow Flint	"	79	167	2.59	13.5	2.67	**13.17**
100 Gold Medal Dent	Yellow Dent	Firm Dough	80	129	2.54	13.4	3.26	**12.72**
101 Smoky Dent	Reddish Dent	"	86	140	3.05	13.1	3.78	**12.63**
102 Squaw	Variegated Flint	Ripe	65	164	2.96	9.4	3.08	**11.79**
103 Red Glazed	White Flint	"	75	156	3.11	11.2	3.03	**11.10**
104 Dakota Gold Coin	Yellow Dent	"	76	155	2 99	10.9	2.87	**10.75**
105 Rawlings	" "	"	73	155	3.15	8.2	3.26	**9.17**
106 Excelsior Yellow Dent	.....	.....	60	147	2.24	5.9	2.14	**6.25**

TEST OF 131 VARIETIES OF CORN FOR SILAGE FODDER OR GRAIN.—*Continued.*

Varieties.	Kinds of corn.	Average results for 1895.					Average results for number of years grown.	
		Condition of grain when harvested.	Height of plants.	Number of ears per plot.	Yield of ears per acre.	Yield of whole crop per acre.	Yield of ears per acre.	Yield of whole crop per acre.
Grown for one year:			ins.		tons.	tons.	tons.	tons.
107 Mexican June	.....	.....	91	....	.....	20 9	.....	20.90
108 Sale Mammoth	Sweet	Late Milk	81	136	2.63	17 9	2.63	17.90
109 Primitive	Yellow Flint	Milk	79	140	2.41	17.9	2.41	17.85
110 Golden Row	Yellow Dent	Dough	89	135	3.28	17.6	3.28	17.55
111 Old Cabin Home	White Dent	Milk	99	86	.75	17.2	.75	17.20
112 Dungan's White Prolific	"	Late Milk	98	110	2.20	16.9	2.20	16.90
113 Montgomery Golden King	Yellow Dent	Dough	90	114	2.41	16.2	2.41	16.20
114 Riley's Yellow Dent	"	"	100	112	1.97	15.7	1.97	15.70
115 Connecticut Giant Golden	White Flint	Ripe	79	141	3.04	15 5	3.04	15.50
116 Pride of Columbia	Yellow Dent	Firm Dough	90	133	2.83	15.1	2.83	15.10
117 Conqueror	"	Late Milk	91	88	1.54	14.7	1.54	14.70
118 Indian White Flour Corn (white cob)	White Flint	Firm Dough	77	156	3.75	14.7	3.75	14.65
119 Great Western	Yellow Dent	Ripe	90	140	2.84	14.4	2.84	14.40
120 Maumee Valley Yellow Dent	"	Firm Dough	94	129	2.84	14.4	2.84	14.35
121 Indian White Flour Corn (red cob)	White Flint	"	71	150	3.87	14.3	3.87	14.30
122 Langworth	White Dent	"	89	154	3.60	14.0	3.60	14.00
123 Golden Dew Drop	Yellow Flint	Ripe	82	163	3.25	13.9	3.25	13.88
124 Golden Prolific	Yellow Dent	Firm Dough	91	112	2.31	13.7	2.31	13.70
125 Dakota Sweet	Sweet	"	74	152	3.32	13.4	3.32	13.35
126 Hathaway's Yellow Dent	Yellow Dent	Ripe	90	141	3.26	13.2	3.26	13.15
127 Terrebonne	White Flint	"	56	123	2.45	12.3	2.45	12.30
128 Wisconsin Yellow Dent	Yellow Dent	"	84	135	2.86	11.1	2.86	11.10
129 Indian Blue	Variegated Flint.	"	61	204	3 34	10.4	3.34	10.35
130 McColl	Black Flint	"	46	214	2 68	10.3	2.68	10.30
131 Will's Jehu 70-Day	Yellow Flint	"	51	155	2.48	6.9	2.48	6.85

By referring to Bulletin 56, issued by the Ontario Bureau of Industries, the reader will see that the area devoted to the growing of corn is rapidly increasing in Ontario. The acreage devoted to field corn in 1895, was 302,929 acres; and the average for the past four years was 242,259 acres. The acreage devoted to silage and fodder corn in 1895 was 148,899 acres, and the average of the past four years was 112,132 acres. This shows a much larger area devoted to corn for husking and for the silo in 1895 than in the average of the years since 1892.

We believe that the best variety of corn in nearly all circumstances, is the one that will produce the largest total weight per acre; that will produce the largest amount of grain per acre; and will mature in the locality where grown before the frosts come in the autumn of the year. In order to obtain accurate and valuable information on these points as well as on others regarding the varieties of corn, we have conducted a somewhat elaborate series of interesting experiments.

We refer the reader to the foregoing table, which contains the results of our corn experiments for 1895 and in some instances the average results for the number of years that the different varieties have been tested in our experimental department. The varieties are arranged in the list according to their total average yield of green crop per acre for the number of years grown.

Chester County Mammoth. It will be observed that the Chester County Mammoth variety of corn heads the list in average yield of green crop per acre, among fifty-three varieties which have been grown for five years in succession on our experimental grounds. This, however, is a very late variety and one not at all suited to Ontario.

Rural Thoroughbred White Flint. The third variety on the list in average yield per acre is the Rural Thoroughbred White Flint. This is also a late variety, the grain only reaching the milk stage by the middle of September in the average of five years' experiments. It is, however, a corn quite extensively grown in some of the sections of Ontario; and on light, warm, dry soils, it has frequently given very satisfactory results.

Cloud's Early Yellow. Among the heaviest yielding varieties of those tested for five years, Cloud's Early Yellow has given the best all-round satisfaction, as it is the earliest of all the heavy varieties, and it produces a large amount of ears per acre. In average yield of ears per acre, the Cloud's Early Yellow has been surpassed by only three other varieties, which are the Mammoth Cuban, Wisconsin Earliest White Dent, and Compton's Early. It is a yellow dent variety and grows to a good average height, being somewhat taller than the Thoroughbred White Flint. In the co-operative experiments over Ontario, during the past season, Cloud's Early Yellow and the Rural Thoroughbred were two among the six varieties distributed; and Cloud's Early Yellow gave about three-quarters of a ton per acre more than the Rural Thoroughbred White Flint. There was also four-fifths of a ton of ears per acre more from Cloud's Early Yellow than from the Rural Thoroughbred White Flint variety.

Mammoth Cuban. For the central part of Ontario, the Mammoth Cuban is one of the best varieties according to the results of our experimental work. It produced nearly as much as the Mammoth Southern Sweet variety, and is much earlier. In yield of ears per acre, the Mammoth Cuban is surpassed by only one other variety among the fifty-three grown for five years.

Improved Leaming. The Improved Leaming variety is one which comes in the same class as the Mammoth Cuban; but the Mammoth Cuban has given better all-round satisfaction than the Improved Leaming, as it has produced a greater quantity of ears per acre, and has also given a little higher total weight of green crop. In ripening, the Improved Leaming and the Mammoth Cuban are very similar. In the co-operative experiments over Ontario during the past year, the Mammoth Cuban gave an average of about three-quarters of a ton per acre of total weight more than the Improved Leaming, and it also gave an average of half a ton of ears per acre more than this variety.

Salzer's North Dakota. Of the early maturing varieties, Salzer's North Dakota has given us the best all-round satisfaction among the varieties tested for five years. It is a beautiful white flint corn, which is well suited for the central and does well in many of the northern parts of Ontario. It nearly always ripens well at Guelph. In the average of five years' experiments, it has produced nearly seventeen tons of green crop per acre. The Salzer's North Dakota is suitable for the silo, for dry fodder, or for the production of grain. It was one of the six varieties sent out over Ontario in the co-operative experiments of 1895, and in the average of twenty-nine experiments it produced the largest number of good ears and the smallest number of poor ears of the six varieties under test.

Compton's Early. The Compton's Early variety of corn has been grown over Ontario for a number of years, and is now fairly well known. It is a good variety, but in the southern and central parts of Ontario it does not produce a sufficient quantity of total green crop per acre as compared with a number of the other varieties. It is specially adapted to the production of grain, and, in the northern part of Ontario, is suitable for silage and fodder. It was also one of the varieties used in the co-operative experiments in 1895, and we found that it was surpassed in total green crop per acre, in yield of ears per acre, and in number of well developed ears by Salzer's North Dakota, which is also an early variety.

Fodder Corn—Different Distances Between Drills and Between Plants in the Drill.

This experiment was conducted for three years in succession previous to 1895. It consisted in planting a late, a medium, and an early variety of corn in drills, thirty, thirty-six, and forty-two inches apart, and leaving the plants at a distance of four, eight, and twelve inches in the drill. The crop was put in in triplicate in the spring of 1895, but, owing to a lack of complete germination of the seed, the results of the experiment are not given for this season.

Fodder Corn—Seed Selected from Different Parts of the Ear.

An experiment was conducted in 1894 and in 1895 by planting grain taken from the small end, the middle and the large end of the ear, and also from the whole ear. The grain used for this experiment was grown in the experimental plots in 1894. The corn was planted in hills 36.9 inches apart both ways, and four plants were allowed to remain in each hill. The conditions of soil, manuring, cultivation, etc., were similar to those for the variety tests. The corn was all cut on the same day and weighed immediately upon being cut. The ears were then husked and weighed immediately after being husked.

Selection.	Yield of ears per acre.		Yield of whole crop.	
	1895.	Average, 2 years.	1895.	Average, 2 years.
	tons.	tons.	tons.	tons.
Small end of ear	3.08	3.18	13.20	13.83
Large end of ear	2.86	3.10	13.65	13.01
Whole ear	2.36	2.79	12.00	12.20
Middle of ear	2.23	2.98	10.70	12.15

It will be observed that the above table gives the results for 1895 and also for the average of the two past years. The results of the two years are somewhat different. The grain from the large end of the ear gave better results relatively in 1895 than in 1894, while those from the middle of the ear gave the best relative results in 1894. In the average of two years' work the results from the seed taken from the small end of the ear has made a very good record indeed, and one which is different from what many would expect. This experiment will likely be repeated for several years.

Fodder Corn—Selection of Seed.

For this experiment two varieties of corn were used in 1894 and three varieties in 1895. The corn was obtained from seedsmen during each year, and was supposed to be choice samples. From each of the samples used in 1895, a selection was made of large plump seed, of small plump seed, and of inferior seed. The inferior seeds were all whole, but were in most instances dark or mouldy at the germ. The corn was planted in hills 39.6 inches apart each way. Planting took place on May 29th. An equal number of grains was sown of each selection. The experiment with the inferior grain was not conducted in 1894. The sample packages from which the selections were made consisted of two pounds each.

Selections.	Yield of ears per acre.		Yield of whole crop per acre.	
	1895.	Average, 2 years.	1895.	Average, 2 years.
	tons.	tons.	tons.	tons.
Large, plump grains	7.9	5.33	16.9	16.65
Small, plump grains	6.7	4.52	12.8	14.10
Inferior grains	2.6	.....	6.4	.....

From an examination of the results of this experiment, it is found that the large plump grains produced the best results throughout, small plump grains the second best, and the inferior grains the poorest.

Fodder Corn Planted at Different Depths.

In the spring of 1895 Cloud's Early Yellow and the High Mixed varieties of corn were each planted one, two and three inches deep. The experiment was conducted in duplicate. An exact number of grains was planted in every instance, and no thinning of the plants took place. The conditions as to character of soil, the method of cultivation, etc., were exactly the same for this experiment as for the variety tests. Planting took place on June 1st, and the corn was cut about the middle of September, at which time it was weighed and also husked; and the ears were weighed immediately after being husked.

Depths of planting.	Yield of ears per acre.	Yield of whole crop per acre (green).
	tons.	tons.
1 inch deep	4.76	18.9
2 inches deep	4.96	20.3
3 inches deep	4.68	20.0

As this is the first year that this experiment has been made, no definite conclusions can be drawn, but the experiment tends to show that corn planted at a depth of two inches will give better results than that planted at one inch or three inches. The season and soil, however, will have much to do in determining the comparative advantage on the three depths of planting.

Millet—Comparative Test of 20 Varieties.

Varieties.	Average height, 1895.	Yield of crop per acre when first cut.	
		1895.	Average for number of years grown.
Grown for four years:	ins.	tons.	tons.
German or Golden	31	12.40	8.12
Salzer's Dakota	34	10.36	7.72
Golden Wonder	30	12.04	7.70
East India Pearl	24	8.64	6.15
Common	28¾	6.12	5.03
White French	28½	5.68	4.69
Red French	22½	4.70	4.02
Broom Corn	25½	4.20	2.79
Grown for three years:			
Hungarian Grass	26	6.28	5.48
Grown for two years:			
Magic	27½	10.42	7.41
Canadian	31	10.92	7.00
California	24	5 00	4.06
Hog Millet	23	3.76	3.18
Russian	24	3.64	3.02
Grown for one year:			
Holy Terror Gold Mine	27½	12.64	12.64
Japanese (cross gallis)	26	10.54	10.54
" (Millicum)	27	10.48	10.48
" (Italicum)	19½	10.32	10.32
Canary	27	9.60	9.60
Manitoba	30	4.04	4.04

Eight varieties of millet have been grown in the experimental department for four years in succession. Besides those grown for that length of time, one variety has been grown for three years, five for two years, and six for one year. The twenty varieties of millet were grown in duplicate; the seed of one set was sown on June 5th, and the seed of the duplicate test on June 10th. The plots were each one hundred and sixtieth of an acre in size in both sets of this experiment. The seed was sown broadcast at the rate of forty pounds per acre. We cut the crop just after it came into head, and weighed the product at once. The yields per acre have been estimated from the actual yields of the plots.

The yields per acre in 1895 were very good, the largest being upwards of twelve tons of green fodder per acre.

German or Golden. The German or Golden millet now occupies the highest place in yield of crop per acre among the eight varieties of millet that have been grown for four years in succession. Owing to its large yield during the present year the average has been considerably increased. Up to the present time the Salzer's Dakota has occupied first place in point of yield.

Salzer's Dakota. The Salzer's Dakota millet did not do quite as well in 1895 as in the previous years. The plants were not so vigorous. The seed of the Salzer's Dakota obtained in 1892 was very excellent, and produced a crop which we find it very difficult to surpass. We have a few ounces of the seed still on hand, and we are now trying to increase the quantity by careful growing. In the co-operative experiments over Ontario the Salzer's Dakota, Common, Golden Wonder and Hungarian Grass were distributed in 1895. The average results show that the Salzer's Dakota gave the largest yield over Ontario. This variety has now occupied first place in the co-operative experiments for four years in succession.

Sugar Cane, Broom Corn, Kaffir Corn, etc.

Twelve varieties of Sugar Cane, Broom Corn, Kaffir Corn, etc., were grown in the Experimental Department during the past year. Ten of these varieties were also grown in 1894. They were planted on plots one-hundredth of an acre in size on the 8th of June in drills five links apart, in much the same way as corn is often sown.

Varieties.	Kind of crop.	Average height.		Yield of heads per acre.		Yield of whole crop per acre.	
		1895.	Average 2 years.	1895.	Average 2 years.	1895.	Average 2 years.
		inches.	inches.	tons.	tons.	tons.	tons.
1 Fodder	Sugar Cane	70	78 0	.07	.06	15.65	17.84
2 Early Orange	"	67	70 0	.08	.08	13.13	17.52
3 Early Amber	"	66	76.5	.54	.43	13.65	16.93
4 White African	"	55	60.0	.0	.0	13.75	15.63
5 California Golden	Broom Corn	42	66.0	.90	1.25	8.95	10.33
6 Kaffir Corn	Kaffir Corn	47	50.5	.0	.0	10.50	9.15
7 Yellow Millo Maize	Millo Maize	54	53.5	.75	.90	8.80	8.70
8 Dwarf	Broom Corn	41	58.5	1.06	1.37	6.95	8.13
9 Improved Evergreen	"	44	63.0	1 10	1.69	7.20	7.50
10 Jerusalem Corn	Jerusalem Corn.	49	52.5	.92	1.10	5.50	5.40
11 Early Minnesota	Sugar Cane	88	.....	.68	.....	13.25	.....
12 Branching Doura	Branching Doura	52	.....	.93	.....	7.83	.....
13 Early Japanese	Broom Corn	75	.....	1.69	.....	7.55	.....

It will be observed that among the ten varieties which have been grown for two years in succession, the four varieties of Sugar Cane stand at the head of the list in average yield per acre. The Fodder Sugar Cane gave an average of 17.8 tons per acre in the two years' experiments. This variety also gave the highest yield of all the varieties tested during the present year.

Mixed Grains Grown for Fodder.

The interest in fodder crops is growing year by year, as the dairy and other industries which require an increased amount of animal food, are more largely developed in this Province. During the past four years we have sown oats, peas, barley and spring wheat separately and in various combinations, in order to find out which crop would be the most suitable for producing a large amount of valuable food to be used as green fodder or for hay. The experiment has been carried on in duplicate during each of the four years. The grains each year were sown separately and in various combinations, with two and three kinds of grains in each combination, and also in a mixture of all four kinds together. This would make in all fifteen plots in each set, or thirty plots in the duplicate experiments. The plots were each one-hundredth of an acre in size, and the seed was sown on April 26th. The land grew a crop of peas in 1894, and has not been manured for at least six years. The following table gives the average results of the grain grown singly and in the various combinations, as indicated in the table:

Crops.	Yield per acre of green crops grown separately.			Yield per acre of green crop grown in mixtures.				
	1894.	1895.	Average 2 years.	1892.	1893.	1894.	1895.	Average 4 years.
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
1. Peas and Oats	8.02	7.92	7.97	10.95	6.01	8.14	6 91	8.00
2. Barley and Peas	6.77	7.68	7.23	8.50	5.93	7.25	6.85	7.13
3. Barley, Peas and Oats	7.19	7.18	7.19	9.95	5.30	7.25	5.45	6.99
4. Barley and Oats	6.79	5.93	6.36	7.08	6.12	7.29	6 63	6 78
5. Peas, Wheat and Oats	6.73	6.43	6.58	8.20	6.94	6.46	5.28	6.72
6. Barley, Peas, Wheat and Oats	6.43	6.24	6.34	9 85	4.01	6.43	5.14	6.36
7. Wheat and Oats	6.10	4.81	5.46	7.58	5.28	6 64	5.48	6.25
8. Barley, Wheat and Oats	5.91	5.10	5.51	8.60	4.77	6.36	5.20	6.23
9. Peas and Wheat	6.08	6.56	6.32	7.95	4.48	5.89	5.64	5.99
10. Barley, Peas and Wheat	5.90	6.26	6.08	7.45	3.98	6.21	5.17	5.70
11. Wheat and Barley	4.85	4.57	4.71	6.15	4.81	5.20	4.65	5.20

The peas and oats have given the largest yield of green crop per acre in the average of four years. Not only does this combination make a good crop in regard to yield per acre, but it also produces a fodder of excellent quality, as the oats furnish an abundance of carbohydrates, and the peas a good quantity of albuminoids, thus forming a well-balanced ration. It will be noticed that peas are in the three highest yielding mixtures, and that wheat is in all mixtures which gave the poorest yield of green crop.

Peas and Oats Sown in Different Quantities for Fodder.

Mixtures of grain.	Yield of green crop per acre.				
	1892.	1893.	1894.	1895.	Average 4 years.
1. Oats 1 bushel, and Peas 3 bushels	11.35	6.32	7.79	9.21	8.66
2. " 2 " " 3 "	11.75	6.52	7.00	9.28	8.64
3. " 2 " " 1 "	11.55	6.28	6.89	9.68	8.60
4. " 1½ " " 1 "	12.10	4.88	7.21	9.40	8.40
5. " 1½ " " 2 "	11.85	5.88	6.54	9.30	8.39
6. " 1½ " " 3 "	11.40	5.72	6.46	9.58	8.29
7. " 1 " " 1 "	11.80	4.68	7.61	8.84	8.23
8. " 1 " " 2 "	10.75	4.18	7.79	9.65	8.09
9. " 2 " " 2 "	10.10	5.36	7.07	9.78	8.08

This experiment was conducted in duplicate plots in 1895, and has now been carried on for four years in succession. Different portions of peas and oats have been mixed together in such a way that some valuable information should be gleaned in regard to the best combinations for fodder purposes. The seeding in 1895 of one set took place on April 27th, and of the other set on May 8th. The seed was sown broadcast in every instance.

It will be noticed that the largest yield per acre for four years has been produced by sowing one bushel of oats and three bushels of peas combined. This mixture, however, is apt to lodge very badly, and we find that, all things taken into account, two bushels of oats and one of peas, or one and a half bushels of oats and one of peas mixed, is a very good combination for a crop which will yield well, usually lodge but little, and form a good quality of feed, and it forms a good combination of carbonaceous and leguminous plants.

Sunflowers—Comparative Test of 7 Varieties.

In 1895 seven varieties of sunflower seed were obtained from different seedsmen, most of them from the United States. The seed was planted in rows twenty-five inches apart on June 8th. The land was cultivated similar to that on which the corn was planted. The varieties were cut on the same day, and the results given were as follows:

Varieties.	Average height.		Yield of heads per acre.		Total yield per acre.	
	1895.	Average 2 years.	1895.	Average 2 years.	1895.	Average 2 years.
Grown for two years:	inches.	inches.	tons.	tons.	tons.	tons.
1. Helianthus Globosus	65	65.0	4.58	4.65	12.58	10.63
2. Texas Silver Queen	46	58.0	.23	2.72	4.83	8.82
3. Black Giant	64	58.0	3.05	3.97	9.10	7.75
4. Mammoth Russian Giant	59	58.5	1.98	3.19	5.93	6.13
5. Common	64	63.0	1.94	3.37	5.79	5.42
6. Double California	54	42.5	1.68	2.04	5.73	4.87
Grown for one year:						
7. Silver and Gold	39		.69		11.39	

The yield of sunflowers per acre in 1895 was greater than that of 1894. The foregoing table gives quite full information in regard to the production of the different varieties.

Fodder Crops—8 Varieties.

A very interesting experiment was conducted in 1895 with eight varieties of crops which should be fairly well suited for fodder purposes. The experiment was conducted with these eight varieties on both new and old land, and the results given below are the average of the duplicate experiments. The plots were one-hundredth of an acre in size in every instance. The seeding of one set took place on May 8th, and of the other on May 9th. The crops were harvested when in about the right condition for feeding

purposes. They were carefully judged by six judges acting independently of one another. The notes taken were carefully summarized and are given in column four of the table below. The feed from each variety was also taken to the stables and fed to the dairy cows to find out which ones was most relished by the animals.

Varieties.	Average height of crop.	Average yield per acre.	General appearance as a valuable crop for fodder purposes. 1=most. 10=least.	Relished by cattle when fed in the stable. 1=most. 10=least.
	inches.	tons.		
Rape	17.0	17.06	5	1
Yellow Soy Beans	22.8	11.26	8	3
Egyptian Peas	16.8	10.91	7	10
Grass Pea	38.9	10.43	1	2
Prussian Blue Peas	46.5	10.36	2	3
Tares or Vetches	29.0	10.16	2	2
Crimson Clover	14.0	7.58	4	1
Horse-beans	27.5	7.38	6	9

It will be observed that the rape gave the largest amount of green crop per acre, yielding nearly twice as much as any of the other varieties. The rape was also eaten very readily by the animals in the stable. The Egyptian Peas and Horse-beans appeared to be relished by the animals the least of any of the varieties in the experiment.

Rape—Comparative Test of 7 Varieties.

For two years we have grown a few varieties of rape on a small scale in our trial grounds. The seed of these varieties were kindly furnished by the Steele-Briggs Seed Co., Toronto. In each of the two years in which this experiment has been conducted, one row of each variety two rods in length, was sown.

Varieties.	Height of plants.		Kinds of plants.	Weight of ten best plants in 1895.
	1895.	Average, two years.		
	inches.	inches.		pounds.
Dwarf Essex	33	23.8	biennial.	7
Large Seeded Winter	24	20.5	"	10
Umbrella, large seeded	23	19.0	"	10
Dutch Rape, large seeded	22	17.0	"	5
White Flowering	19	15.8	"	2½
Yellow Flowering	16	16.3	"	3
Russian Summer, large seeded	36	37.5	annual.	4½

There are several of these varieties which resemble the Dwarf Essex, and it will be noticed that the Large Seeded Winter and the Umbrella Large Seeded produced larger average sized plants than the Dwarf Essex. As this experiment, however, was conducted with such small lots of seed, we are unable to glean little more than a knowledge of the characteristics of the different varieties under test.

Rape—Comparative Test of 2 Varieties.

The Dwarf Essex Rape is one which is used almost entirely for cultivation in Ontario, and in the Northern States. The Victoria variety was recommended very highly indeed by one of the American seedsmen as being a variety much superior to the Dwarf Essex. We sowed some of the seed of each of those varieties in duplicate plots the past year. Each of the plots was one-hundredth of an acre in size.

Varieties.	Yield of green crop per acre.
	tons.
Dwarf Essex	15.15
Victoria	14.55

The growth of the two varieties was quite similar throughout, although the Victoria seemed to be, if anything, a little taller. In average yield per acre, however, the Dwarf Essex has produced three-fifths of a ton per acre more than this new variety known as the Victoria.

Rape—Selection of Seed.

An experiment was conducted during the past year, in which a selection of rape seed was made from what might be considered an average sample of the seed on the market. The selection was large and plump seed, medium sized seed, and small seed. The medium seed, however, was sound and whole, the large seed was carefully hand-picked and was choice in plumpness, etc. The experiment was conducted in duplicate. Exactly the same number of seeds was used for each experiment. Each plot consisted of one row, four rods in length. The following table gives the results of the experiments:

Selections.	Yield of green crop per acre.
	tons.
Large and plump seed	13.13
Medium-sized seed	9.23
Small sound seed	3.28

The large and plump seed shows a marked increase over the other selections in average yield of green crop per acre, as it produces about one-half as much again as the medium-sized seed, and over four times as much as was produced from seed of small size.

Rape—Thinning Plants to Different Distances in the Drills.

An experiment was conducted in 1895, in which the rape plants when about two inches in height, were thinned to different distances in the drills, the distances being, two, four, eight and twelve inches. The experiment was conducted on plots one-hundredth of an acre in size, and the test was made in duplicate.

Distance between the plants in the row.	Yield per acre of green crop.
Two inches	14.45 tons.
Four inches	14.25 "
Eight inches	13 83 "
Twelve inches	11.23 "

It will be remembered that even the thinning to two inches apart is not at all close in comparison with the way rape is usually sown. There is the largest average yield from the plots which contain the plants closest together, and the smallest yield from the plots that contain the plants which are thinned to the greatest distance apart. The widest distance between the plants, however, gives an opportunity for the individual plants to become well developed, and a very fine crop is realized. We believe from what we have seen in connection with different experiments in rape growing, that the tendency throughout many parts of the Province is to sow the seed too thickly. About one pound per acre has given excellent results in our experimental department.

Rape—Methods of Cultivation.

An experiment was conducted with rape in 1895 by sowing the seed broadcast, by sowing it in rows on the flat and cultivating between the rows; by sowing in rows on light ridges, and cultivating between the rows; by sowing in rows on light ridges and sub-soiling the ground at the time of seeding and afterwards cultivating the ground between the rows. The land upon which this experiment was conducted was an average clay loam which had been manured in the spring of 1893, at the rate of twenty tons of farmyard manure per acre, and had produced a crop of winter wheat in 1894. The rows were four rods in length, and twenty-six and two-fifth inches apart. The seeding took place on June 24th. The crop was weighed immediately on being cut. The yields per acre have been estimated from the actual results of the plots.

——	Yield of green crop per acre.
Sown broadcast	5.3 tons.
Sown in rows on the flat and cultivated	5.7 "
Sown in rows on light ridges and cultivated	5.5 "
Sown in rows on light ridges and sub-soiled at time of seeding	6.7 "

It will be noticed that the plots which were sub-soiled gave the largest average yield of green crop per acre. The yield of rape was light in every instance owing to the very dry weather. The lightest yield was produced from the broadcast sowing.

Pumpkins and Squashes—Comparative tests of 9 Varieties.

Nine varieties of pumpkins and squashes were planted in the experimental department on May 25th. There were two hills of each variety. One hill was well manured and the other was left without any special manuring. In the well manured hills, only one-half were allowed to grow, while in the unmanured hills three plants were allowed to remain in each hill. As the weather was very dry, the hills were all watered three or

Varieties.	Yield of pumpkins and squashes from plants unmanured.	Yield from one vine of each variety well manured.
		lbs.
King of the Mammoths Pumpkin	138.0	618.0
Rennie's Yellow Mammoth Squash	88.0	552 0
Thorp's Mammoth Pumpkin		387.5
Mammoth Tours Pumpkin	51.5	358.0
Mammoth Bright Red Etampes Pumpkin	37.5	282.0
Rennie's Green Mammoth Squash	166.0	253 0
Buckbee's New Sandwich Island Pumpkin	47.0	200.0
Large Cheese Pumpkin	17.5	122.5
Centennial Field Pumpkin	116.0	82.5

four times with water from an adjacent stream. The vines were not cut back, nor were the plants fed in any way except by the manuring they received.

King of the Mammoth, which was obtained from the States, gave the largest yield. Upon the one vine which was well manured, there were twelve well-developed pumpkins; and upon the one vine of the Rennie's Yellow Mammoth squash, there were also nine well-developed specimens. The product of these two vines was shown at the Central Exhibition held in Guelph last autumn.

Clovers—Comparative Test of 9 Varieties.

In the spring of 1894, nine varieties of clover were sown in the experimental department. Barley was sown at the rate of one bushel per acre along with the clover. The seeding took place on May 12th, 1894. No protection was afforded the plots during the past winter. Two crops of clover were produced by some of the varieties during the present year. The following table gives the results for 1895:

Varieties.	Uniformity of the crop over the land.	Average height of plants.	Yield of freshly cut crop per acre	
			First cutting July 4th.	Second cutting. October 22nd.
			tons.	tons.
Bokhara or Sweet Clover	good	32	9.44	.08
Lucerne or Alfalfa	"	12	2.40	.96
Alsike	"	9	2.88	.00
Sanfoin	"	14	2.32	.00
Long Red Rawdon	medium	10	1.84	.24
Yellow Trefoil	good	7	1.76	.00
Mammoth Red	medium	10	1.24	.24
Common Red	medium	12	1.20	.24
Perennial Red	medium	11	.92	.12

It will be observed from the above table that six out of the nine varieties of clover gave a second crop. This, however, was very light in the case of most of the varieties. Bokhara, or Sweet Clover, produced the largest average yield of freshly cut clover per acre. This, however, is a very coarse plant and the hay is not relished by animals. It is used in some cases as a green manure. The Lucerne, or Alfalfa, stands second in total yield of crop per acre during the past year. The red clovers came through the winter the poorest of all those mentioned in the foregoing table. The severe frosts in the spring affected the Lucerne or Alfafa, the most of any of the varieties. Had it not been for the frosts, the Lucerne would likely have produced three good-sized cuttings. The crop from each plot was made into hay and then weighed in the dry condition. It is found very difficult, however, to get the crops of all of the varieties cured uniformly, and the results of the cured hay are therefore not given in the preceding table.

Crimson, or Scarlet Clover

Trifolium Incarnatum.

Inquiries are frequently received from farmers throughout Ontario regarding the cultivation of Crimson or Scarlet Clover. When we consider that it is so successfully grown in New Jersey, Delaware, Maryland, and a few of the other American States, and that by some men of experience it is called the "mortgage lifter," can it be wondered that our people are anxious to learn about its adaptability to the Province of Ontario? As we have had four years' experience with Crimson Clover at our Agricultural College, it is the purpose of the writer to give in a few words the result of that experience. It might be well, however, to give first a short description of the plant and mention the uses to which it is put where most successfully grown.

Description of the Plant.

Crimson clover is an annual, producing seed and dying within one year after it is sown. If the seeding takes place in the spring the growth is rapid and the seed is produced during the same season, after which the plant dies. When sown in July, August or September, the growth is slow, and if the winter is not too severe, the plant lives till the following year when it completes its growth and ripens its seed. If the crop is pastured in the early spring the plants usually renew their growth and mature about the usual time. The blossoms grow to about two inches in length and are of a brilliant crimson color, which gives a beautiful appearance to a field of this clover when in full bloom. The roots grow very rapidly and penetrate quite deeply into the soil even when the seeding is done in the spring of the year.

Crimson clover is one of the leguminous crops, and investigations in this line tell us that it has the power of making use of the free nitrogen of the atmosphere, being somewhat similar in this respect to peas, beans and common red clover.

Utilization of the Crop.

In those parts of the country where Crimson clover is grown the most successfully, various uses are made of the crop. In some of the Eastern States it is grown very extensively for green manuring and for the production of hay and seed, and, to a limited extent, for pasture, soiling, and silage purposes.

The fact that the Crimson clover and other leguminous crops of a similar nature are able to make use of the free nitrogen of the atmosphere is of great importance, not only in the enrichment of the soil by the addition of this expensive element of plant food, but also in the production of animal food of high nutritive qualities, owing to the large amount of this same element, nitrogen, in its composition. A two-fold use of nearly the whole of the nitrogen of these leguminous crops may be taken advantage of by first feeding the crops to farm animals and then carefully saving the manure and returning it to the land for future crops.

Crimson Clover in Ontario.

Experience with Crimson clover in Ontario is still quite limited. During the present year, however, it has been tested for spring sowing pretty generally over the province through the medium of our Agricultural and Experimental Union. Last spring packages of seed sufficient to sow one-tenth of an acre each, were sent to one hundred and twenty-seven leading farmers throughout Ontario. The average results of the co-operative work go to show that in some sections the Crimson clover did exceedingly well, while in others it was a failure. The average height of the crop was 11.1 inches and the average yield of green crop per acre was 4.35 tons.

In four years' trials of sowing Crimson clover in the spring, at the Agricultural College, we have obtained an average of about $1\frac{1}{10}$ tons of hay per acre. When the seeding took place in April, May, or very early in June, the plants bloomed during the same season, after which they immediately died. Ten and fifteen pounds of seed per acre have produced about equally good results. The plants have reached an average height of from twelve to eighteen inches.

During the month of August of the present year, nine kinds of green crops were fed to cows in the stable, and it was found that rape and Crimson clover were the most palatable. In six determinations made this season, an average of thirty-one pounds of Crimson clover hay was obtained from the curing of each one hundred pounds of the green crop that was cut when in bloom.

Crimson clover, common peas, buckwheat, rape and spurry were sown separately on about two and a half acres of the experimental grounds early in May of the present

year. With the exception of spurry, the crops grew luxuriantly and were admired by the thousands of Ontario farmers who visited the College in the month of June. The crops were all plowed under early in July, and winter wheat is now growing on the land. Interest will be taken next year in watching the effect on the wheat crop of the different kinds of manure used.

In the autumn of 1894 about three acres of winter wheat stubble land were sown with Crimson clover. The germination of the seed was good and the plants had reached a height of about two inches by the time winter set in. On examining the crop in the spring we found that only a few of the plants had survived the severe winter weather. It should be remembered, however, that winter wheat in an adjoining portion of the experimental grounds was killed during the same season much more extensively than that grown during any of the five years previous. The plants on a section of the land were allowed to ripen and the seed was carefully gathered for future growing, with the object of trying to ascertain if a plant can in time be produced that will be as hardy in Ontario as our winter wheat is at present. We invite the co-operation of farmers over the Province in the future testing of Crimson clover as a winter crop and would be pleased to receive the experience of any in regard to this plant. It would be a valuable addition to our list of crops if we could get a legume that could be grown on the land between harvest and the time of planting corn, potatoes, turnips, rape, etc., the following spring.

Grasses—Comparative Test of 21 Varieties.

On May 15th, 1894, thirty-one varieties of grasses were sown in our experimental plots. During the winter of 1894 ten of these were killed out so badly that the experiment with these varieties was discontinued. Twenty-one varieties came through the winter fairly well and have made a fairly good growth during the present season, when we consider the extreme dryness of the summer. The following table gives the particulars in regard to the yields of the different varieties :

Names of varieties of grasses.		Uniformity of the crop on the land.	Average height when cut.	Yield of green crop per acre.
Common.	Scientific.		inches.	tons.
1. Lyme Grass	Elymus Virginicus	good	30	8.84
2. Western Rye Grass	Agropyrum tenerum	medium	27	8.76
3. Bearded Wheat Grass	Agropyrum caninum	good	30	6.80
4. American Lyme Grass	Elymus Americanus	medium	15	5.32
5. Fringed Brome Grass	Bromus ciliatus	poor	18	3.76
6. Soft Brome Grass	Bromus mollis	very good.	23	3.44
7. Awnless Brome Grass	Bromus inermis	good	24	3.16
8. Timothy	Phleum pratense	"	25	2.64
9. Tall Oat Grass	Arrhenatherum avenaceum	medium	24	2.60
10. Orchard Grass	Dactylis glomerata	good	11	2.32
11. Meadow Fescue	Festuca elatior	"	18	2.24
12. Rhode Island Bent	Agrostis canina	medium	14	1.40
13. Red Top	Agrostis vulgaris	"	15	1.36
14. Meadow Foxtail	Alopecurus pratensis	"	21	1.24
15. Perennial Rye	Lolium perenne	"	12	.92
16. Kentucky Blue	Poa pratensis	"	15	.84
17. Creeping Bent	Agrostis stolonifera	poor	13	.56
18. Fine Leaved Sheep's Fescue	Festuca ovina	medium	11	.40
19. Yellow Oat	Avena flavescens	poor	10	.32
20. Wild Timothy	Muhlenbergia glomerata	"	11	.28
21. Canadian Blue	Poa compressa	"	8	.20

It will be observed that some large yields were obtained from several of the varieties. Numbers one, two, three, four, five, and twenty are natives of Canada, and were obtained through the kindness of Mr. S. A. Bedford, Superintendent Experimental Farm, Manitoba. The Orchard Grass was very badly affected by the frosts in May, or it would likely have made a much higher record. Further work will be done along this interesting and valuable line of experimental research.

Permanent Pastures.

A considerable amount of experimental work has been devoted to the growing of grasses and clovers, both singly and in combination. In the spring of 1894, two mixtures of grasses and clovers for permanent pasture were sown in our experimental grounds. On one plot, the mixture which was recommended at this place in 1895 was used; and on the second plot, the mixture which was recommended in 1893 was sown. These were sown without any other crop during the first season. In 1895, we were enabled to cut two crops from each mixture. The following table gives the results of the two mixtures for the past season:

No. 1. Mixture recommended at O. A. C. in 1895.			No. 2. Mixture recommended at O. A. C. in 1893.		
Grasses or clovers.	Varieties.	Amount of seed used in mixtures.	Grasses or clovers.	Varieties.	Amount of seed used in mixtures.
		lb.			lb.
Grasses	Meadow Fescue	6	Grasses	Orchard Grass	4
"	Meadow Foxtail	3	"	Meadow Fescue	4
"	English Rye	2	"	Tall Oat Grass	3
"	Timothy	3	"	Timothy	2
"	Canadian Blue	4	"	Meadow Foxtail	2
"	Orchard	3	Clovers	Lucerne	5
"	Red Top	2	"	Alsike	2
"	Yellow Oat	2	"	White or Dutch	1
Clovers	Lucerne	4	"	Yellow or Trefoil	1
"	White	2			
"	Alsike	2			
"	Red	1			
"	Yellow	1			
	Total amount seed used.	35		Total amount seed used.	24

Yields during 1895.

Mixtures.	Average height of first crop.	Yield of green crop per acre.		
		First cutting, July 4.	Second cutting, Oct'r 22.	Total from the two cuttings.
	ins.	tons.	tons.	tons.
No. 1	24	5.12	2 88	8.00
No. 2	25	5.76	5.52	11.28

It will be observed that number two mixture produced a total yield of green crop of over three tons per acre more than that of number one mixture. There was, however, less seed sown on number two than on number one. In number one mixture some of the grasses are small, such as Canadian Blue, Red Top, and Yellow Oat. In number two the varieties of both grasses and clovers have proven to be quite hardy for this climate, and are all fairly good yielders. The Meadow Foxtail is perhaps the lightest yielder, but it is the earliest grass on the list. It will be interesting to watch the comparative results of these plots in future years.

Sacaline, (*Polygonum Sachalinense.*)

A great deal has been said and written about this plant by seedsmen in the United States and by a few of the seedsmen in Ontario. Up to the present time we know but very little of it in Canada. In the early spring of 1894, I wrote to the Agricultural Experiment Station in Iowa in regard to this plant, and they kindly furnished me with four roots; these I planted in my garden and watched them very closely. The plants grew to about eighteen inches in height in 1894. The growth in the spring of the present year was quite rapid, the plants having reached a height of one foot or more at the time of the May frosts, when they were frozen to the ground. In three or four weeks after the frosts, the plants again sent forth new growth, each reaching a height of about three feet during the summer.

Besides the plants secured in 1894, we obtained some roots and seed during the spring of the present year. The plants which grew from the roots reached a height of about two feet, and those from the seeds, a height of from six to ten inches.

Miscellaneous Crops.

Experiments were conducted during the past year in testing four varieties of peanuts, two varieties of Chicory, one variety of Flax, one of Hemp, one of Gorse, one of Cufas, one of African Goober, one of Swiss Chard, two of Kohl Rabi, and one of Upland Rice. Further experiments will be made with a number of these crops, and the results will be reported from time to time.

Respectfully submitted,

C. A. ZAVITZ,
Experimentalist.

Ontario Agricultural College,
Guelph, Dec. 31st, 1895.

PART XI.

REPORT OF

FARM SUPERINTENDENT.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit herewith my annual report for the year 1895, and it affords me no little pleasure to be able to report that notwithstanding the unusually bad season (which was ushered in by a severe frost on the night of the 13th of May, followed by a long-continued and severe drouth), we have had a fairly prosperous year. Our crops were all good, with the exception of clover and fall wheat. These two crops were so injured that they only yielded about one-third of an average crop. Owing to the specially favorable weather in the early part of the season, the clover was coming into bloom when the frost cut it off as though it had been mowed, the heavier places suffering most. After the frost the frozen clover formed a thick, heavy mulch which prevented the air from reaching the roots and lower parts of the stem, which soon began to turn yellow. On noticing this, we horse-raked about twenty acres and found that it had a very beneficial effect.

We had intended to pasture number nine field (twenty acres), which was an old meadow, mostly timothy, but after the frost, number eleven (twenty-five acres) was pastured instead. We had nearly two tons per acre of good timothy hay from number nine, while the rest of our meadow, which was clover, yielded only about half a ton per acre.

Of grains, we have been growing only those varieties which have proved to be the best in the experimental department. In the beginning of March a price list is issued, which is sent to any farmer who applies for seed grain.

FALL WHEAT.

Our fall wheat was sown on field number twenty-one, on Lucerne clover sod from which one crop was cut. The second crop was allowed to grow up and was plowed under, and the land was thoroughly tilled before sowing. The wheat grew nicely till the May frost, which injured it very considerably, so that with the drouth following (which was specially disastrous to this field, owing to its high position and gravelly nature) the crop yielded only about ten bushels per acre. Three varieties were grown, viz., Dawson's Golden Chaff, Early Genesee Giant, and American Bronze. The two first named varieties yielded the best returns; so, profiting from last year's experience, we have sowed only these two varieties this year.

Spring Wheat.

Field number fourteen, which had been in roots the previous season, was sown on April 18th to 20th with three varieties of spring wheat, viz., Herison Bearded, Pringle's Champion, and Haynes' Blue Stem. The two former varieties were harvested on August 3rd to 5th and were a good crop; but, owing to the fact that we have not finished threshing yet, the yield cannot be accurately given.

The Blue Stem is a late variety, not being ready to cut until August 13th; and, by this time fully one-half of it was broken down from the work of the Hessian fly in the lower joint, so that we have discarded it from our list for next year. We intend to sow only the Herison Bearded and Pringle's Champion.

Oats.

Two varieties of oats were grown, viz., the Siberian and the Poland White. The former is a superior oat both for quality and yield. They were sown on April 17th and 18th, were harvested on August 8th to 12th, and will yield fully seventy-five bushels per acre. The Poland White is an earlier oat, with shorter straw, and is not quite so productive. This variety was sown on 20th to 22nd of April, and harvested July 30th to August 1st.

Barley.

The Mandscheuri is so much more productive than any other variety, that we sowed no other this season. It was sown April 23rd, and harvested July 24th to 26th; and, although it is not yet threshed, we estimate the yield this year at about forty-five bushels per acre

Peas.

In peas, the Prussian Blue has been the leading variety grown on the farm for several years. It is a vigorous grower and an abundant yielder. This year we have had an enormous crop which will yield not less than thirty-five bushels per acre. It was sown on April 24th and 25th and harvested on August 13th.

Corn.

Thirty-five acres were sown on 22nd to 26th of May, with four varieties of corn for ensilage, viz., Wisconsin Early White Dent, Mammoth Cuban, High Mixed, and Leaming. The two first named varieties were most satisfactory, giving a fairly good yield of well eared and well matured corn, nearly one-third of the total weight of ensilage from these varieties being ears. Cattle fed on such ensilage require very little grain. On the 15th of September we had several degrees of frost, which injured the corn somewhat, especially in the lower portions of the field. On the 16th we commenced cutting and finished on October 22nd, filling both silos. We put 250 tons into the dairy silo and 200 tons into the farm silo.

We sow our corn with the ordinary grain drill, stopping all the tubes but two, and thus leaving the rows forty-two inches apart. We sow about twelve pounds of seed per acre, as we find that thin seeding gives better ensilage. When the crop is comparatively thin we get a larger percentage of ears and the leaves on the lower portion of stalk remain green until cut.

Millet.

Seeing that hay would be a short crop owing to the May frost and the subsequent dry weather, we sowed millet on four acres of new land intended for rape, and also on four acres in the orchard. It was sown on July 4th and 5th, and cut on September 23rd to 25th, and it yielded about two tons per acre of excellent hay.

Rape.

Five acres of rape were sown on the 21st of June, in drills twenty-five inches apart. We kept it thoroughly cultivated during the summer, and we had an abundant crop. About the 1st of September we commenced feeding; and up to November 1st it was fed to cattle, sheep, and pigs; after that date, only to the sheep. Instead of pasturing it, we cut and hauled it to the pasture field. We find that in that way there is less waste, and we know exactly how much we are feeding. About the 15th of November what remained of it was cut and piled up in large windrows from which it was fed right along until the middle of December.

Field Roots.

Field number one, containing twenty acres of clover sod, was plowed early in the fall of 1894. The land was then thoroughly cultivated, and about twenty loads per acre of barn-yard manure were spread on the surface late in the fall, and allowed to remain until spring, when it was plowed under, quite shallow, harrowed, cultivated with the spring-toothed cultivator, and again harrowed before drilling. Six acres of Yellow Intermediate and Mammoth Long Red mangels and two acres of Red Top Sugar beets were sown on April 26th and 27th in drills thirty inches apart, using a double mould-board plow and marker, and taking pains to have the drills as straight and even in width as possible, in order to facilitate the after cultivation. The seed germinated nicely, but was cut off with the frost on the 13th of May, so we were obliged to split the drills and re sow them. The roots were harvested October 16th and 17th and yielded an average of 600 bushels per acre.

Turnips.

Five acres of the same field were sown on June 20th and 21st with the following varieties of Swede turnips, viz., Rennie's Prize, Bronze Top and Carter's Elephant. The yield of all three was about the same, averaging 600 bushels per acre, but the first two were of a better quality. The turnips were harvested on October 31st to November 2nd.

Potatoes.

Seven acres of potatoes were grown in the same field of the following varieties, viz., Burpee's Extra Early, Rose of Erin, Crown Jewel, Rural New Yorker, Empire State, and Pearl of Savoy. They were planted May 18th to the 22nd in drills thirty inches apart, with the sets one foot apart in the drill, the seed having been cut to two or three eyes per set. We planted them about five inches deep and covered with a double mould-board plow. In about ten days the drills were harrowed down and cultivated with Breed's weeder, which, together with the sulky cultivator, was kept constantly going among the corn, roots, potatoes, and rape. Neither the potatoes nor any of the hoed crops were hilled. They were all cultivated on the flat.

When harvesting we hauled the turnips and mangels directly to the cellar as they were pulled and topped. The potatoes were pitted in the field, covered lightly, and left there for ten days, when they were removed to the cellar, except those intended for seed, which were pitted in the orchard.

Twelve acres of fall wheat were sown on August 26th in field number five, from which a crop of peas had been taken. The land was cultivated with the spring-toothed cultivator as soon as the peas were off, then cultivated with the broadshare cultivator; and, as we only had a limited quantity of manure, it was applied to the higher portions of the field and plowed under lightly. It was then harrowed and sown with Dawson's Golden Chaff and early Genesee Giant, six acres of each. Grass seed was sown at the same time—three pounds red clover, three pounds Alsike, and four pounds timothy per acre. An additional five pounds per acre of red clover will be sown in the spring.

Cultivation of the Soil.

In the preparation of a seed bed for spring grain, the following system is carried out with very little variation: The land, which has been put in a very thorough state of cultivation the previous fall, is first harrowed, for two reasons; first, to make the wet spots dry out better, and, in the second place, to break and pulverize the dry crust which forms all over the drier portions. We follow the harrows with the spring-toothed cultivator, stirring the ground to a depth of three or four inches. After the cultivator comes another team, with the harrows; then the drill, after which we finish off with another stroke of the harrows. This work was all done with six teams, including the travelling dairy team and the two cart horses. We started on the 17th and finished on the 25th of April, having sown something over one hundred acres. The stones were gathered and the land rolled afterwards.

Fall Cultivation. Soon after haying, three teams were started plowing sod. About 110 acres were plowed. Half of this was rather dirty, with Canada thistle and other weeds; so, in order to get it thoroughly cleaned the harrows and cultivator were kept going until some of it was cultivated ten or twelve times, mostly with the broadshare cultivator, so that every plant was kept cut off, and every foul seed germinated and was destroyed. This land will be sown in the spring, without plowing. From the cultivation it has received, together with the action of the atmosphere in fall, and the snow and frost in winter, there should be a large amount of plant food available for the crop of next year. That portion of the pea stubble, not sown with fall wheat, was first cultivated with a spring-toothed cultivator. Then, instead of plowing we loosened the soil to a depth of six inches with a two-horse grubber. During the fall the land was cultivated twice, with a broadshare cultivator, to kill any weeds that might show themselves.

The corn and root ground was plowed lightly in the fall, in order to bury the roots of the former, and tops of the latter. Were it not for these obstructions, it would be advisable to use the two-horse grubber, instead of plowing under the soil that is in the best possible condition for the following crop.

The stones were then gathered off all the cultivated land, which meant weeks of labor for men and teams, student labor being employed largely for this work. The land is now in good condition for spring seeding.

All the fall wheat, spring wheat, oat, and barley crop, over ninety acres, was seeded with the following mixtures: seven pounds red clover, three pounds of alsike, and four pounds of timothy; and, notwithstanding the severe frost in May, and the subsequent drouth, we have a splendid catch on both high and low land.

To insure a catch the essential points were strictly adhered to, viz.: thorough preparation of the seed-bed, sowing the seed in front of the drill tubes, which insure the distribution of the seed between the rows of grain—a very important point. The grain should not be sown too thick. We sow less than one and one-half bushel per acre, of wheat, oats, and barley, and then, as a finishing touch, we go over the fields after harvest, before the stubble is horse-raked, and sow a little seed on such spots as appear to need it. The late summer and early fall rains cause this seed to germinate, and it grows very rapidly. If this system is strictly followed out, it will be almost sure to give a good crop of clover.

Cleaning the Land. In order to rid the farm of Canada thistles and other noxious weeds, nearly all the cross-fences (which were badly out of repair) have been removed and the land plowed and cultivated.

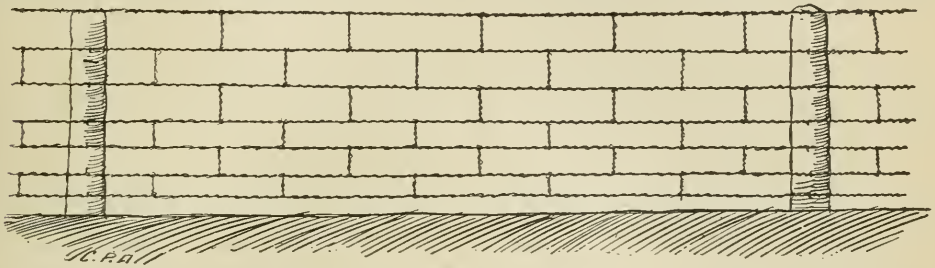
Besides removing what had been a breeding place for weeds, and at the same time facilitating cultivation, by giving us larger fields and long rounds, it is a decided improvement in landscape appearance. The farm, instead of being cut up into twenty fields as formerly, is now divided into five sections; three of these contain about ninety acres, each under cultivation, and the other two, fifty-five and forty acres respectively. These last

two will be cultivated as one in the four year's rotation which is being pursued, viz.: first and second years, meadows and pasture ; third year, peas and hoed crops, including corn, field roots and potatoes ; fourth year, grains—wheat, oats, and barley, seeded down again with grass seed, principally clover.

Four of these sections contain a few acres of woodland each, which will be valuable as a resort for the cattle during the warm weather. It will be arranged to fence off what will be required for pasture, convenient to the woods, using a portable fence which is easily removed.

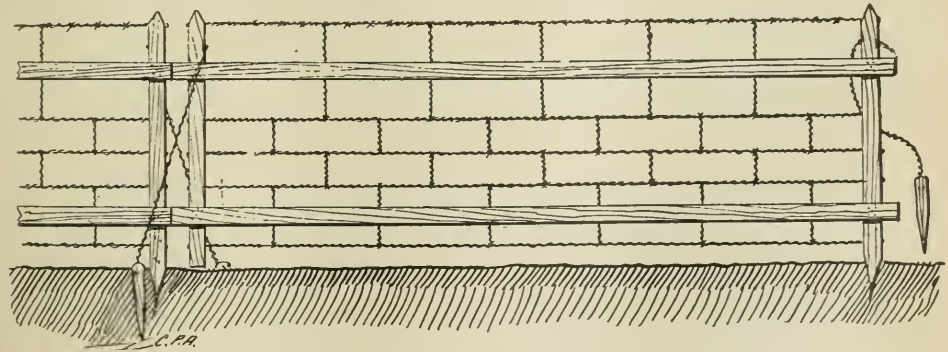
FENCING.

We have now constructed about four miles of boundary fence, including the completion of what was erected last year. The fence adopted is of the following design :



I append a description of the fence which accords very closely with my ideal of a farm fence, being cheap, durable, safe, and effective. It will turn sheep or hogs, as well as cattle. Round six-inch posts are set in the ground twenty feet apart. Owing to the rolling nature of this farm, twenty feet is about the proper distance ; on a level, flat farm, they might be set much farther apart, which would materially reduce the cost of the fence. Seven strands of twisted, number twelve wire and stretched on the posts, six plain and one barbed wire being used, spaced as follows, starting at the bottom : 6,6,6,8,8,9, inches. Cross sections, or stay wires cut to the proper length, are then put on two and one-half feet apart, these are put on very securely with a hook made for the purpose. One man stays about twenty rods per day. These stay wires stiffen the fence and prevent the horizontal wires from spreading apart, so as that it will turn sheep or hogs, as well as cattle, or, if desired, it can be made to turn even poultry. The cost of the fence is as follows : posts nine cents per rod ; horizontal wire twenty-two cents ; cross sections seven cents ; and labor, including digging holes, setting posts, putting on cross sections, etc., eighteen cents. Total cost, fifty-six cents per rod.

A very convenient and durable portable fence, invented by one of our graduates, A. H. Christian, B.S.A., has been tested on the farm with satisfactory results.



It is built in sections, twelve feet long, and nearly four feet high (more or les desired). Each section contains about nineteen feet of lumber and four pounds of wire .

Each section consists of two head pieces one and one-half by three inches and four feet three inches long; and four horizontal pieces, one by three inches, and twelve feet long. The common cable number twelve twisted fence wire is used throughout, including the cross sections and braces.

Construction. The side pieces are nailed to the head pieces and project beyond them four inches, to form the connection, the two bottom pieces are eight inches from the bottom end of the heads; the upper pieces are twelve inches from the top of the heads and on opposite sides. This forms the frame-work of each section. The wires are then stretched, being secured by passing the wire through a three-eighth inch hole in the heads and driving a wooden peg in beside the wire. This holds them secure, while the ends may be turned down and fastened with a staple. The first wire is four inches above the bottom end of the heads, the second is twelve inches above the first, the third six inches above the second, the fourth seven inches above the third, and the fifth or top wire is eight inches above the upper wooden bar of the frame. The top wire is barbed. The cross sections are then put on, the ends being twisted around the wires with a hook for the purpose, the same as in the stationary fence mentioned above. The side pieces of the frame are then nailed together in the centre to hold them tight and secure.

Setting and securing the hurdles. The hurdles (or sections) are held in place by wire braces and pegs driven into the ground, as illustrated in the cut. These wire braces are four feet eight inches long, and fastened to the upper end of each head by a staple on the inside edge of the head. The pegs are made of hardwood sixteen inches long and one and one-quarter by two inches thick, the wire being secured to them by boring a quarter-inch hole through, near the top of the peg, passing the end of the wire through and twisting it round a short piece of wire, thus forming a cross which is not liable to split the peg. On one end of each hurdle is an extension, sharpened at one end and nailed to the side of the bottom end of the head. This enters the ground seven or eight inches and holds the bottom of the fence secure, while the top is held by the braces, which cross each other on the opposite side of the heads, making the connection secure and anchoring the fence firmly. It will be noticed that the spaces in the illustration are very narrow hence the hurdles will turn sheep or pigs. If it is only wanted to turn cattle, the wires might be spaced to dispense with one strand altogether. The hurdles will cost about sixty-five cents each, viz: lumber thirty-five cents, wire fifteen cents, and labor fifteen cents.

Draining.

Sixty rods of six-inch and forty rods of four-inch drains were laid in field number twenty-one, which is partly swamp land. It will be used for pasture next year, and after that it should be in a condition to grow grain and other crops.

Feeding of Live Stock.

This important subject has not received the consideration it should have had from many of our farmers. To feed stock successfully, requires intelligence and good judgment in adapting the food to the kind of animals and to the different stages of development.

Young cattle should be fed bulky and easily digested food—food suited to the production of bone and muscle, such as clover, either cured or green, roots, bran, crushed oats, etc. Young stock fed on such food regularly and moderately, develop into strong, healthy animals.

A diet for young animals, containing an excess of rich, concentrated food tends too much to the production of fat, renders an animal liable to disease, and is likely to check, or stunt it in its growth. Animals should be fed according to the object desired. For breeding purposes, it is important that both male and female be fed on food that will produce bone, muscle, and flesh, instead of fat.

On the sixth of Nov., 1894, sixteen steers, rising three years old, were purchase in the Guelph market at three and one-half cents per pound, the average weight per animal being eleven hundred and fifty-seven pounds. They were fed largely on rape until Christmas, receiving in addition night and morning, a mixture of cut hay, chaff, pulped roots, and ensilage, about twenty-five pounds per day, the cost of food, including rape, being about seven

cents a head per day. During January, February, and March, they received no hay. The food given them was a mixture of chaff, ensilage, and pulped roots, fifty pounds per day, fed in three meals at 5 a.m., 12 noon, and 6 p.m. The cost for each animal was about eight cents per day, including four pounds of grain and bran. With these rations from the sixth November till the end of March, one hundred and forty-four days, they gained an average of two hundred and sixty-five pounds per head, or 1.84 pounds per day. Allowing forty pounds each for shrinkage, the net gain was 1.56 pounds each per day for the one hundred and forty-four days. During April, the same rations was continued, with the exception that cut clover hay was substituted for the chaff, and the average gain was fifty and one-half pounds per day, or say one and one-third per day.

During May, they were fed on four pounds of peameal and two pounds bran, with clover hay, ensilage, and pulped roots, fifty pounds to each animal, at a cost of ten cents per head per day, and they gained twenty-six pounds per animal, or say five-sixth pounds per day.

From the first of June, the food was forty-five pounds per clover hay and ensilage, mixed in the proportion of one to four by weight, together with seven pounds of ground grain (barley, rye, and wheat) and bran. The cost of this ration was twelve cents, and the average gain was one pound per head per day.

The steers were sold to Messrs. J. A. Leaman & Co., of Halifax, Nova Scotia, for five and one-half cents per pound live weight and shipped on July 26th.

Results.

Cost of sixteen steers on Nov. 6,		
Total weight, 18,512 pounds at 3½ cents	$	647 92
Cost of food from		
Nov. 6 to Dec. 31, 55 days at 7c. per head		61 60
Jan. 1 " Mar. 31, 89 " at 8c. "		113 92
Apr. 1 " May 31, 61 " at 10c. "		97 60
June 1 " July 25, 55 " at 12c. "		105 60
Total cost	$	1,026 64

Results.

Gross weight July 25th,		
24,890 pounds at 5½c	$	1368 95
Total cost		1026 64
Net profit	$	342 31

In these estimates, clover hay is valued at $7.00 per ton, chaff nothing, ensilage $2.00 per ton, roots $2.50, mixed grain 1 cent per pound, and bran $12.00 per ton.

It will be observed that the greatest gain for the food consumed was during the first five months, while the steers were fed on the coarse, bulky, and easily digested food. The last three months they were fed at a loss, while they were being fed on the stronger and more concentrated food. The decreased gain was, of course, owing in part to the warm weather and the advanced stage of feeding.

Had the steers been sold in May, as is the usual custom, there would have been a much larger profit, as will be seen by the above figures. They were kept until July, that the large number of farmers visiting the College in June and July might see the result of this method of feeding.

The milk cows were fed the same as the steers during the winter, except that they had an addition of twenty pounds of mangels per day when giving milk. In summer, we give them a feed of ensilage twice a day, when they are tied in for milking. During the season of the hornfly, the cattle are all rubbed over once a week with seal oil (fish oil) and carbolic acid, three tablespoonfuls of the latter to one gallon of the former,

thoroughly mixed. It may be applied with a sponge or cloth, or even with a syringe, and is a sure preventative of the hornfly. One gallon will be enough for thirty or forty cattle.

Sheep. During the winter season, the breeding sheep (60 in all, ewes and rams) are fed morning and evening a mixture of ensilage, chaff, and pulped roots, four hundred and fifty pounds per day, with thirty pounds of bran. At noon they are fed peastraw. The cost of this ration is as follows: Ensilage mixture forty-five cents, bran eighteen cents, peastraw twenty cents. Total eighty three cents, or less than one and one half cents per day for each animal; and the sheep are all in good healthy condition.

Swine. The principles of feeding pigs are similar to those applied to other live stock, viz., animals kept for breeding purposes should be fed on food that will form bone, muscle, and flesh, instead of fat. The brood sows at the farm are fed twice a day on boiled roots, mixed with bran and middlings The young pigs are fed three times a day.

As we have no milk for our pigs, we mix flaxseed in their food as a substitute, for three or four weeks after weaning, about one-half pound per day for each litter of eight or ten pigs.

The cost of the food at the age of four or five months is two and one half cents per day, and the increase in weight is over one pound per day for each animal. After five months, until sold, we substitute peameal for middlings.

The following will show the results from four lots of cross-bred pigs that were sold to Messrs. J. A. Leaman & Co., and shipped with the steers on July 26th.

Lot 1.

Seven animals from Tamsworth sire and Berkshire dam, average weight on

Feb.	13th,	at 4	months,	117	pounds.
Mar.	"	5	"	154	"
Apr.	"	6	"	204	"
May	"	7	"	255	"
June	"	8	"	301	"

Lot 2.

Five animals from Tamworth sire and Chester White dam, average weight on

Feb.	25th,	at 4	months,	96	pounds.
Mar.	"	5	"	131	"
Apr.	"	6	"	167	"
May	"	7	"	226	"
June	"	8	"	267	"

Lot 3.

Eight animals from Yorkshire sire and Poland China dam, average weight on

Feb.	28th,	at 4	months,	102	pounds.
Mar.	"	5	"	137	"
Apr.	"	6	"	186	"
May	"	7	"	226	"
June	"	8	"	256	"

Lot 4.

Four animals from Berkshire sire and Yorkshire dam, average weight on

Apr.	27th,	at 4	months,	99	pounds.
May	"	5	"	138	"
June	"	6	"	177	"

There was little difference in the quantity of food consumed by the different crosses, and the food was limited to what they ate within half an hour after feeding.

The Chester White dam suffered from fever for about a week after farrowing, so that her pigs were badly stunted at the start, from which they did not recover until between four and five months old.

The pigs were inspected by two of the most prominent pork packers in this Province, and the Tamworth crosses were pronounced the most suitable for their purpose.

In order to have roots to boil for the pigs during the entire year, we grow about two acres of sugar beets. They keep till August, when the new crop of mangels is ready to feed. For a time, we boil both tops and roots.

By this system of feeding the best quality of pork can be produced for two cents per pound live weight.

Horses. During the winter season, when the farm horses are comparatively idle, they are fed as follows : Morning and evening, they are fed the same mixture as the cattle, viz.: ensilage, chaff, and pulped roots, say ensilage twenty pounds, chaff five pounds, and roots ten pounds, a total of thirty-five pounds per day for each horse. At noon, they are fed about three pounds of cut clover hay and straw. Their grain ration consists of two and one-half pounds per day of bran and chopped grain mixed. The cost of this ration is estimated at seven cents der day.

When the horses commence work in spring, and during the summer, they receive nine pounds of chopped grain (principally oats) mixed with six pounds of bran per day, and all the cut hay they will eat within one hour after being fed. The total cost is under twenty cents per head per day.

Live Stock for Educational Purposes

The following live stock is kept for educational purposes :

Eight	breeds	of	cattle,	one	male	and two females	of each breed.
Nine	"		sheep,	one	"	six "	"
Five	"		swine,	one	"	two "	"

Practical Instruction.

The first and second year students are required to work on the farm and in other departments each alternative afternoon, for which they are paid in proportion to the work performed, the amount being credited on their board accounts. Lists are prepared, with the names alphabetically arranged, and each student is expected to take his turn at all kinds of work on the farm, among the live stock, at dairying, poultry, horticulture, carpentering, and in the experimental department.

During November, an opportunity is given those students who have had more or less experience in plowing to test their skill in plowing sod. Thirty one students entered into the competition last fall, each plowing in turn according to the number drawn and each using the same plow and horses, plowing five rounds, forty rods long. The time allowed was one hour and the standard size of furrows was set at six inches deep by nine wide. Sixteen awards were made by two competent judges, the work performed being very creditable. Mr. Colin Carmichael, head teamster, attended to numbering the lots and giving instruction.

During the above competition Mr. Wm. Young gave instruction in plowing in a stubble field to those students who required it.

Before the examinations last June, the second year students plowed a ridge each for the purpose of testing their skill ; and marks were given according to the work performed. Messrs. F. Benson and W. Squirrell judged the work by the following standard : For beginning, fifteen ; even holding, fifteen ; shaped ridge, fifteen ; straightness, fifteen ;

and finish, fifteen ; making a total of seventy-five marks. The mininum number to pass being set at thirty-five.

It is gratifying to know that all passed, Mr. J. D. McPhail, of Dundas County, making the maximum number of 75 marks.

Annual Sale.

The annual sale of surplus live stock was held at the farm on Oct. 30th.

On account of conducting some experiments in the early part of the season, in crossing and feeding pigs, and also in feeding early lambs for Easter market, the animals offered were fewer in number and younger than they otherwise would have been. The amount realized for nine young cattle was $211.00, sheep $133.50, pigs $354.75, making a total of $699 25.

I submit herewith a statement of the farm accounts for 1895 :

Receipts.	$ c.	Disbursements	$ c.	$ c.
Sales of cattle	2,150 05	*Running expenses.*		
" pigs	1,067 31			
" sheep	438 80	Wages	2,771 83	
" wheat	314 95	Live stock	1,154 93	
" oats	388 70	Feed purchased (mostly bran and middlings)	524 06	
" barley	288 24	Seeds	282 08	
" milk	151 96	Binding twine	15 47	
" wool	68 61	Repairs, alterations and furnishings	657 52	
" potatoes	9 50	Advertising, printing, postage, etc	186 89	
" old fence	55 28	Fuel, light, etc.	57 91	
" hides and skins	4 90	Contingencies	64 20	
Rent of pasture	12 00			5,714 89
Service of animals	134 00			
Wood supplied dairy, 20 cords @ $1.50.	30 00			
Hay " 4 tons @ $10.00.	40 00			
Mangels " 1,000 bu. @ 7 cts.	70 00			
Ensilage " 250 tons @ $1.30.	325 00			
Pasture " 35 acres @ $4.00.	140 00			
Potatoes supplied college, 1,000 bu @ 20 cts	200 00			
Milk supplied college, 5,241¼ gals. @ 8 cts	419 30	*Other Disbursements.*		
Feed and bedding 2 horses for college.	100 00			
" 2 " garden	80 00	Superintendent's salary		1,200 00
" 4 "experimental	160 00	Permanent improvements (draining, fencing, etc		456 62
Six months feed for 2 horses for travelling dairy	25 00	Tools and implements		397 79
Hay for engineer's horse	25 00			
Filling ice houses, college and dairy	50 00			
Total revenue	6,748 60	Total expenditure		7,679 30

It will be seen from the above figures that, had the farm been run as a private enterprise, it would have yielded a handsome profit, which would have been larger but for the fact that it is necessary to keep so many different breeds of live stock for educational purposes, from which we receive no revenue.

Submitting the above in the hope that it will meet with your approval, I have the honor to be

Your obedient servant,

WM. RENNIE,

Farm Superintendent.

PART XII.

REPORT OF THE

MANAGER OF THE POULTRY DEPARTMENT

To the President of the Ontario Agricultural Society:

SIR,—One year having passed since my appointment to the position of manager of the poultry department, you will expect of me only a short report of the work done.

On entering upon my duties over a year ago, I fully realized the responsibilities resting upon me, in a new departure of so great an importance; and I may say that without an assistant, the work at times has been rather laborious; but it has been lightened by the encouragement I have received from you and members of the staff. I feel assured with a continuance of your confidence and of such co-operation this department will be a benefit to the College and to the country at large.

Not having all my stock purchased until quite late in the season, I did not get the breeding pens made up so early as I desired; yet we have had a fairly successful year.

The fowls being confined in their winter quarters, without any outdoor exercise, did not produce so large a proportion of fertile eggs as we could have wished. Through the months of March, April and May fifty per cent. was the average of fertile eggs, including all breeds; and having received letters frequently from Canada and the United States, asking what the trouble was, I concluded, as it was so general, that the severity and length of the winter had something to do with it. In my case, I did not expect to get a large percentage of fertile eggs, as the stock purchased was nearly all last year's birds. This may not have affected the results; but it has been my experience and that of others, that you do not get so high a percentage of fertile eggs, nor so strong and vigorous chicks from pullets as from older stock. Yet, in our position, we thought it advisable to purchase young birds. Under the above circumstances, we did not have so many early chicks as we should have had if circumstances had been more favorable.

ARTIFICIAL INCUBATION.

Under your instruction, I purchased a hot-air incubator, of one hundred egg capacity, and one of two hundred egg capacity, heated by hot water. I used them according to instructions; the results were not satisfactory. I do not, however, intend to say anything for or against those machines at the present time, for two reasons: First, because I was living two miles away from my department; and, having to walk that distance, I could not watch them so closely, late and early, as seems necessary, in order to obtain the best results; secondly, because hatching under hens did not prove much more satisfactory this year, owing, I think, to the weakness and infertility of the eggs. Now, however, I am in a position to look carefully after the working of these incubators; and, other conditions being more favorable, I hope, at the end of next year, to give you and the public an honest and impartial report of every hatch during

the year, let the results be what they may. I may add that I used a brooder throughout last spring, manufactured by Mr. Meyers, at Kossuth, Ont, and found it to give entire satisfaction.

Buildings and Furnishings.

I found the buildings erected by Mr. Crawford, the College carpenter, under the direction of the president, all that is required for practical purposes In addition to those, we need a small brooder house, which can be built at small cost; and two small houses, to protect our surplus chickens in the fall, till they are disposed of.

We found the furnishings, such as boiler for cooking vegetables and heating water, mill for cutting bone, drinking fountains, perches, feeding troughs, nests, etc., all that could be desired, and we do not know wherein they could be improved.

I must also express my satisfaction and gratification at the character of the dwelling house erected for the use of the manager of the poultry department. It is a first-class house; and, in consequence of its nearness to the poultry houses, the manager of the department will be in a position to look closely after his charge at all times, as is necessary in the case of any one who has charge of poultry.

It was not intended, nor could it be expected, that any experimental work would be done this year. A great deal of work had to be done to complete buildings and yards, before the breeding pens were ready for use; so that there was not the time necessary to put things into shape for any well-considered line of research, until the breeding season was past. In future, we hope to give due attention to work under this head.

Losses from Disease.

The year has not passed without our having some losses to report, as I suppose was to be expected, where a number of fowls of different breeds were kept in close quarters. When fowls have their liberty, they are not nearly so subject to disease as when they are confined. Fowls never perspire; and many troubles that are easily thrown off by perspiration, with them have to be exhaled by respiration; so we find that nearly all the fatal diseases among fowl are in the throat and lungs.

I have not had a case of roup during the year; but I had quite a number of late chicks, too small to be disposed of at our annual sale, which had to be crowded into close quarters at the time when they required the best of care, while shedding their chicken feathers; and they did not thrive so well as they should have done. Late hatched chicks are not profitable; they are a continual source of annoyance, and are very apt to bring disease to the rest of the flock.

During the year I have received inquiries from several farmers and poultry fanciers in reference to diseases of various kinds among their fowl; and in some cases, from the symptoms given, I have found it very difficult to determine the nature of the disease. Hence, for the information of farmers especially, I give below the symptoms of two or three of the diseases most prevalent among fowls, and the treatment in each case.

Distemper.

Cases of distemper, which by the way is often taken for roup, can be diagnosed by the following symptoms: A disposition to remain on the roost in the day time; unusual redness of face and comb; a fulness of the face, as if swollen under the eye; and a white froth discernible in the corner of the eyes. In aggravated cases, the face is very much swollen and the eyes become watery from the closing of the tear tubes. When healthy and diseased fowls are allowed to drink out of the same vessel, the disease is communicated from one to another, until the whole flock is affected. It is better to isolate the affected ones, or use the hatchet (unless the birds are valuable) than to run chances of spreading the disease, which may, if neglected, turn to roup. There is no offensive smell from the breath, as in case of roup.

Treatment. If noticed in time, the disease may be checked without much trouble. Wash the head in warm water, to which add a few drops of carbolic acid, not more than one part acid to twenty parts water; clean the nasal passage and swab the throat with the same solution; and give each bird half a teaspoonful of electric oil. One treatment may be sufficient, in nearly all cases. Roup may be treated in the same way, unless canker has formed in the throat and mouth; in which case it is advisable to gargle the throat with kerosene oil. Treat two or three times, and the canker will generally disappear. At the same time give a teaspoonful of castor oil and provide nourishing food, with a little sulphur added thereto.

Diarrhœa.

In March last, several of the fowls in house No. 1 (where we keep the larger and least active breeds) were taken with this disease. They were troubled with leg weakness; their sight was affected, as is often the case with this disease; and the excrement was of a greenish color. After losing several birds, I had some of them dissected, and I found that the chief trouble was in the liver, which was disordered and considerably enlarged. Mr. F. C. Harrison, our bacteriologist, examined the excrement and the liver, and found the bacillus of chicken cholera in both. This was, no doubt, the immediate cause of the trouble; but I am of the opinion that it was over-feeding and close confinement which furnished the conditions that enabled the germ to do its work. See the report of the Bacteriologist in Part VIII. of this volume.

Treatment. After using several prescriptions, without effect, I concluded to try epsom salts, giving as a dose half a teaspoonful dissolved in water; and I am pleased to say that it had the desired effect. In some cases, I had to give two or three doses; but, in every instance, the fowls improved rapidly, and in a short time the flock was restored to good health.

If we expect to be successful in the raising of poultry, we must watch our flock while well so as to prevent sickness. We must keep a watchful eye upon them while on the roost, and observe their droppings closely from day to day. If the excrement shows a costive tendency, feed less grain and more vegetables, such as cabbage or boiled potatoes, mashed with bran and middlings, or turnips or beets, thrown into the pen. On the other hand, if the droppings show a relaxed tendency, feed less vegetables; mix your soft food as dry as possible, using milk, instead of water, for mixing; and give them milk to drink, sweet or sour.

If we provide our fowls with dust baths, to which some sulphur is added to dust themselves in from time to time during the winter; if we avoid as far as possible the use of permanent or box-made nests that cannot be easily cleaned; if we use kerosene oil freely on roosts and in nest boxes; if we dust our fowls occasionally with Persian insect powder; if we keep everything about our fowls scrupulously clean, and feed them judiciously, we shall take a few important steps towards success in the management of poultry.

Lectures.

The lectures given to the students in the class-room, have been illustrated, as far as practicable by specimens taken from the breeding pens, and the instruction at work in the houses has been made as practical as possible.

The following is a brief outline of the work covered in the lectures:

Technical terms pertaining to the different parts of poultry; how to select breeding stock, proper mating, etc., characteristics of the Asiatic, American, Mediterranean, and French breeds of fowls; where and how originated; the good points and the defects of each; their standard weights; the disqualifications, and the different points to be obtained in the various classes.

How to apply the standard by the scoring system; the feeding and management of poultry; diseases of fowls; causes and treatment of the same.

Visitors.

Thousands of people have visited this department during the year, some of them the largest and most successful breeders of thoroughbred poultry in America. They were loud in their praises of the quality of the stock and the completeness of the buildings, yards, surroundings, etc.

Under your direction the drives, yards and lawns have been put into shape, and we have endeavored to keep them as clean and tidy as possible, with the help that was at our command.

Disposal of Eggs.

A great many orders were received for eggs, especially of the following breeds: Barred and White Plymouth Rocks, Silver and White Wyandottes, Brown and White Leghorns, Minorcas and Andalusians.

Having only a few hens of each breed, and requiring a great many for the use of the department, we could not begin to fill the orders of the above mentioned breeds. I filled the orders as far as I could in the order of application; and those who waited so patiently, if they so desire, will have the preference next season. The amount, which will be one dollar and fifty cents per setting, should accompany the order and be sent direct to the Bursar. If the order cannot be filled in a reasonable time, the money will be refunded at once. Eggs from each pen will be tested from time to time, and no eggs will be sent out, unless a large percentage of them prove to be fertile and in every way satisfactory for setting.

I find it necessary to make a few changes in our breeding stock. This will be the case every year, as, in some instances, the mating may not give good results. We will therefore have to purchase a few birds to complete pens, and to fill the places of a few varieties which we saw fit to discard that we might try others which would be more suitable for practical purposes.

Respectfully yours,

L. G. JARVIS,
Manager Poultry Department.

Ontario Agricultural College,
Guelph, Dec. 31st, 1895.

PART XIII.

REPORT OF APICULTURIST.

To the President of the Ontario Agricultural College:

SIR,—In submitting to you my first annual report, I would respectfully beg to state that, owing to the extraordinary frosts in May, the unusual variation in temperature, and a large deficiency of rain and snowfall in 1895, few in Ontario have obtained any surplus honey from clover, thistle or basswood; and there is only a small surplus from buckwheat. There has been scarcely any swarming, and, unless apiarists have fed heavily, many colonies will die of starvation. Such an unusual season has made it difficult to carry on experimental work. Such work as has had for its object a comparison of some methods of producing the best comb honey, never reached completion; and therefore such an experiment gave no results of any value. It is our intention to repeat this work during the season of 1896. Again, the poor season left the bees which are kept for purposes of instruction at the College, pratically at a standstill during the months that they are required for this purpose; and, for this reason, the students did not secure the benefits which would have been derived, had the strength and condition of the colony changed from week to week, as might generally be expected at that time.

THE EXPERIMENTAL APIARY.

Anyone taking in hand experimental work in the apiary, will find but little to guide him. The very few who have labored along these lines in the past, after exercising more than average forethought and care, have found, as they progressed in this work, that at times it has been practically valueless, owing to the lack of consideration of some essential point, the importance of which was not thought of until the work was taken in hand. On account of the newness of the work, we are still laboring under this difficulty. In the experiment in wintering, I have to report that, although the general result from the experiment will doubtless be unaffected, yet, in the light of ideas which have suggested themselves to me during the past two months, I think it would be well to conduct a test along the following lines: To take two sets of colonies; one with bees fully matured and having had several flights before winter, and the other with young bees not sufficiently matured to go into winter quarters, the bees otherwise as far as possible under similar conditions. In future, when conducting experiments, to be careful to select colonies which are alike in this respect, and not, as heretofore, select them without regard to this condition. So far as I know, this has never been taken into account by any apicultural experiment station.

WINTERING PROBLEM.

Any light that can be thrown upon the wintering problem will be very acceptable to bee-keepers generally. To define my position clearly, I may say that for the last six years I have wintered my bees, from sixty-two to ninety-three colonies, with an average loss of between three and four per cent. Cellar wintering has been the system adopted. During the fall of 1894 my opinion was asked concerning a book, "The Wintering Problem in Bee-keeping," professing to be an exposition of the conditions essential to success in the winter and spring management of the apiary; and I may here refer very briefly to the contents of that work. The theory submitted was in brief as follows: That bees that wintered in trees and in gums, wintered better than they generally do in the movable frame hives; that bees situated in trees and log gums sometimes perished from excessive swarming, by being short of stores, or by loss of their queen; that bees so domiciled in gums were sometimes afflicted with what is now called bee-diarrhœa, but that

this did not often happen, as the conditions which bring it about were not so liable to occur.

The aim of winter protection for bees should be:

(1) To reduce the heat *conduction* of the hive to the lowest possible point.

(2) To conserve the heat given off by the bees, so that it will remain in the hive until gradually lost by diffusion with the cool air in the lower part.

When absorbent material, such as forest leaves, chaff or planer shavings, is used above the cluster, it is gradually saturated and thus changed into a rapid heat conductor, thus defeating the first object aimed at. The second object is also defeated, because more or less warm air escapes at the top, and all the heat contained in the absorbed moisture is carried outside of the hive chamber. When a tight cover is used, very little warm air escapes at the top; and the moisture, when deposited on the side walls, gives up its heat gradually, until it reaches the bottom board. This released heat again returns to the upper regions of the chamber and thus assists in keeping the atmosphere within the hive at the proper temperature, the water meanwhile escaping at the entrance. These are the conditions that are found in the gum or hollow tree, which, from natural formation, has abundant warmth at the top and is rendered impervious to moisture by the sealing of the bees. Further, in a tree, the lower portion of the compartment is comparatively cool; and, if any moisture is condensed, it is in the lower part of the hive. As hives are generally prepared now, with little or no packing above, the under side of the quilt is cooler than the atmosphere, when it rises more or less saturated. The same is the case when absorbents are used and become conductors, cooling the quilt above. When this condition obtains the warm atmosphere, as it rises saturated with moisture from the cluster of bees beneath, strikes the cool surface above, is chilled, and deposits its moisture, as we see it in every-day life on the cool window pane. This moisture, when it collects in sufficient quantities, drops and falls on the cluster, to the great injury of the health of the bees. causing disease and bee-diarrhœa. By packing them in the way about to be described, the condition found in the log or hollow tree is secured. Such was the reasoning of Mr. Pierce. The entire theory is exceedingly plausible; and, I know from correspondence, that it has had its followers.

In my experiment, ten colonies in eight-frame, single-walled, "Langstroth" hives, were prepared, weighing, without lid, but including bottom boards, body of hive, frames, bees, quilt, and stores, as follows, Oct. 29th, 1894:

Clamp 1. No. 1, 58 lbs.; No. 2, 57; No. 3, 59; No. 4, 56; No. 5, 58; No. 6, 58; No. 7, 55; No. 8, 54; No. 9, 57; No. 10, 61.

The bees were placed in what bee-keepers generally call a clamp, specially constructed for the purpose. It was of pine, and, for convenience, had the bottom in one piece, the sides and ends each of one piece, and the cover in two pieces, all hooked together, so as to be removed, piece by piece, when desired. The roof has one-third pitch, sloping to the back, to prevent the fall of rain, etc., at the entrance. The hives rest on 2x4 inch scantling, turned on the narrow side, thus making the packing space four inches, and one fourth inch added in back when the bottom boards of the hives rest on the four inch scantling, making the back a little higher than the front, to prevent moisture from running in at the entrance.

There was a little over three inches of space for packing between the hives six inches back and front of the hives, and eight inches on the sides, with room for ten inches of packing above. The space in the bottom of the clamp was filled with planer shavings. The wooden covers were removed from the hives and the sealed quilts were left on. Purposely, the quilts had not been removed since the bees sealed them; and said quilts rested flat on the top bars, having no passage from comb to comb over the frames. Manilla tissue paper was now taken, of a sufficient size to cover the top of the hive, and put on to the depth of one inch, making 672 thicknesses of this paper. Ten thicknesses of newspaper were then put over this, all large enough to allow the edge to extend over the sides and ends to within an inch of the bottom board. The flaps of the corners were folded and all held tight to the sides of the hive by a cord. A bridge made of wood, the length and

width of the alighting board, and one-half inch strips were placed at the entrance, to give the bees free passage out and in, after the packing was placed about the hive. The hives were now thoroughly packed at the sides and ends, and finally on the top, to a depth of eight inches, as nearly as such packing could be measured. It will be seen that in this arrangement the bees were thoroughly protected by packing, with the exception of the entrance, the width of which was controlled by entrance blocks. It will also be noticed that the bees were packed, to avoid the condensation of moisture in the upper part of the hive, and to prevent the absorption of moisture above, with the object of securing its condensation in the lower part of the hive or as it leaves the entrance.

Clamp 2. A similar clamp with ten colonies was also packed, weights as follows :

No. 11, 62 lbs.; No. 12, 57 ; No. 13, 59 ; No. 14, 56 ; No. 15, 58 ; No. 16, 58 ; No. 17, 55 ; No. 18, 54 ; No. 19, 57 ; No. 20, 61.

The bees were prepared in every respect the same as before ; but the manilla tissue paper was omitted, and according to my usual custom four thicknesses of newspaper were laid on in its place on top of the quilt. The quilt, before packing, was broken loose by raising, thus preventing any slight sealing. Eight inches of planer shavings were then added, this, with the quilt, making the top packing.

In both experiments, the entrance by which the bees went into winter quarters was five inches wide. The only precaution observed during the winter, was to see that the entrance and passage to the entrance, was kept clear of dead bees and snow. When necessary, dead bees were carefully and noiselessly removed by means of a bent wire.

Observations. Many times, during November and December, it was markedly noticeable that the bees in No. 1 clamp were flying, when those in No. 2 were perfectly quiet, and that their flight indicated a restless condition. There was, however, no outward signs of disease during these months. Towards spring, the bees in No. 1 clamp showed decided signs of bee-diarrhœa. When they flew, there was spotting. Some of the entrances showed spotting; hives 2, 3, and 10, markedly so. The bees in No. 2 clamp did not show signs of bee-diarrhœa to anything like the same extent. In fact, there was a marked contrast between the two clamps. It will be remembered that a portion of the winter was unusually severe, the temperature dropping at Brantford to 22° below zero. An examination was made on April 18th ; and, as might have been expected from external appearances, with the exception of No. 1, every hive in clamp 1, showed more or less signs of dysentery. Nos. 2 and 3 perished, leaving their combs badly daubed and also leaving small patches of brood in the combs, an indication of exhausted vitality among the bees and an effort to recuperate by breeding young bees. No. 9. in the same clamp, was weak and queenless ; but, as a note went to show that this colony had been queenless in the fall and that a queen had been introduced before going into winter quarters, she might have been temporarily accepted and then destroyed. No. 9, should, therefore, be left out of consideration. In the following list of hives in Clamp 1. XXXX denotes a choice colony, covering, fairly well from seven to eight frames, XXX covering five to six, XX covering three to four, X covering one to two :

No. 1, XXXX ; No. 2, Dead ; No. 3, Dead, No. 4, XXX ; No. 5, XXX; No. 6, XX ; No. 7, XX ; No. 8, XXX ; No. 9, Queenless ; No. 10, X.

The next examination was made April 26th. At this time there was no marked difference in most of the hives, except that No. 7 and No. 10 had perished, having been robbed either just before or after their death. Another examination was made June 1st.

Number of hive.	Number of combs with bees.	Amount of brood, Langstroth frames.
No. 1	8	7
No. 4	6	5
No. 5	3	2½
No. 6	4	3
No. 8	4	2½

It was not the intention to carry this experiment to a test of the amount of honey gathered, as other conditions would influence the result; but it may be of interest to know that the honey season was exceedingly poor, and on July 23rd No. 1 had gathered (allowing 25 pounds per hive for comb and bees,) 33 pounds of honey, stored in the body of the hive, and 17½ pounds stored in the sections. No. 4 had stored 14 pounds in the body of the hive but had no surplus; in fact, on none of the others were surplus receptacles put, as only strong colonies gathered any surplus in the apiary.

The second clamp wintered much better, but did not reach anything like a desirable standard for wintering. On April 18th the facts were as follows:

No. 11, XXXX; No. 12, XXX; No. 13, XX; No. 14, XXX; No. 15, Dead; No. 16, XXX; No. 17, XXXX; No. 18, XX; No. 19, XX; No. 20, XXX.

On April 26th No. 20 was dead, making two dead in the clamp. Another examination was made June 1st, with the following results:

No. 11, XXX; No. 12 XXXX; No. 13, XX; No. 14, XXX; No. 16, XXX; No. 17, XXX; No. 18, XXX; No. 20, XXX.

Number of hive.	Number of combs with bees.	Amount of brood, Langstroth frames.
No. 11	6	5
No. 12	8	7½
No. 13	3	7½
No. 14	6	5
No. 16	5	3½
No. 18	8	7
No. 20	6	5

The remainder of the apiary (73 colonies), with the exception of one colony, was wintered in the cellar, and, owing to the severity of the winter, it was a difficult matter to keep the atmosphere pure and the temperature high enough, hence the loss was a little higher than usual. Only three, however, died, which is a much more satisfactory showing than in either of the clamps wintered outside. Regarding the latter, I may say that I am inclined to the belief that the bees packed with the paper had not sufficient ventilation at the entrance, and the paper packing prevented upward ventilation. In the second clamp some upward ventilation was possible. I do not know of any other way of accounting for the results.

During the winter of 1895 and '96, the experiment will be repeated, with this important difference, that passages will be allowed through the combs, to enable the bees to contract and expand the cluster, according to temperature, yet without having to break the cluster, which is a very important advantage.

Feeding of Bees.

In an experiment in feeding bees sugar syrup for winter stores, the "Boardman" Entrance Feeder was used. It is an *air* feeder in which the bees have ready and continuous access to the syrup and at the same time find it impossible to daub themselves with the liquid. By this arrangement same waste is avoided. In our experiment, the bees had a continuous supply of syrup; and, so far as we are aware, the conditions under which the syrup was stored, were the best. The stores supplied were made of two parts best granulated sugar to one part (by measure) of water. The water was first brought to a boil; then the sugar was poured in and the mixture stirred until the sugar had dissolved and mixture had come to a boil. It was supplied to the bees a little above blood heat. In looking at the table, we notice that there is a considerable difference between the first weight of the hive, plus the syrup, and the actual weight six days after the last syrup was stored. The difference in weights may be attributed to evaporation, the consumption of stores which goes on all the time under natural conditions, and the increased consumption likely to go on whenever the bees are under the excitement or stimulus of storing and for

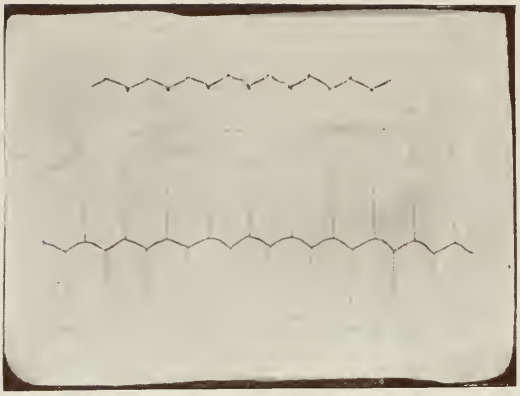


FIG. 1 (*c*).

Giving a side view of comb foundation, 15 sq. ft. to the pound, and above the same after the comb has been completed and capped by the bees. The honey has been extracted and washed away from the comb, which, after a thorough drying, has been filled with plaster of Paris and a section cut down.

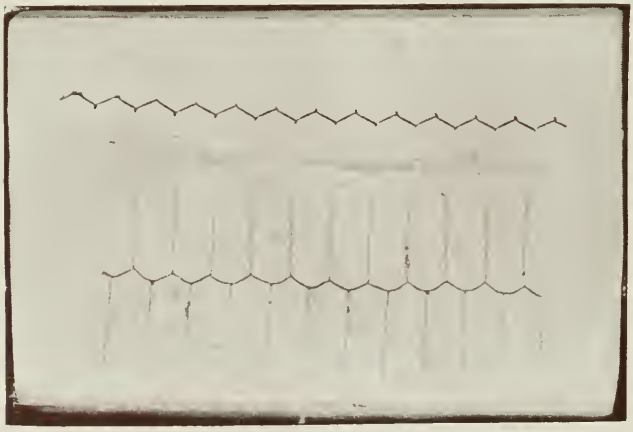


FIG. 2 (*b*).

Giving a side view of comb foundation, 12 sq. ft. to the pound, and above the same after the comb has been completed and capped by the bees. The honey has been extracted and washed away from the comb, which, after a thorough drying, has been filled with plaster of Paris and a section cut down.

FIG. 3 (*f*).

Giving a side view of comb foundation, flat bottomed, 12 sq. ft. to the pound. This shows a continuous piece of foundation. One half of the foundation was covered over, the other half exposed and worked out by the bees.

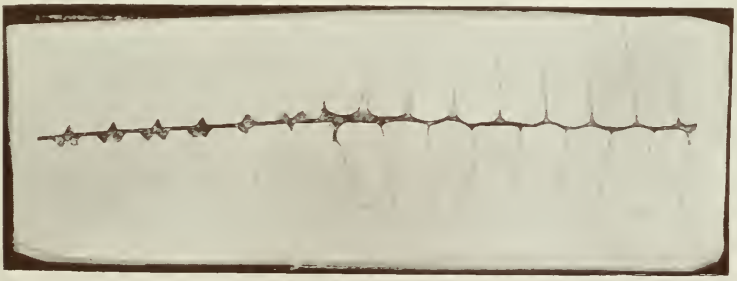


FIG. 4 (*e*).

Giving a side view of comb foundation, flat bottomed, 4 sq. ft. to the pound. This shows a continuous piece of foundation. One half of the foundation was covered over, the other half exposed and worked out by the bees.

The following description refers to the table on page 291 :

	sq. ft. per lb.
(*a*) Is uncolored foundation, "Root" Mill..	10
(*b*) " " " ..	12
(*c*) " " " ..	15
(*d*) Vaudevort.....	12
(*e*) Vanduzen	4
(*f*) "	12
(*g*) "	$6\frac{1}{2}$
(*h*) Is a natural worker comb.	
(*i*) " drone "	

some time thereafter. The colony weighing 33 pounds was not strong enough, and it will be noticed that in this case there was the greatest waste.

Number of colonies.	Weight in pounds.	Pounds of syrup supplied.	Weight six days after last syrup was fed.	No. of pounds gained by said feeding.	Difference between first weight, plus syrup supplied and the actual gain in pounds.	Percentage of loss during process.
1	36	27	51½	15½	11½	.61
1	37	10	41½	4½	5½	.55
1	35½	18½	47	11½	7	.37
1	33	14	37	4	10	.71

The above experiment indicates :

(1) That there is a greater difference between the weight of stores supplied to the bees in the feeders, and the increase in weight of the hive. There is a loss which cannot be explained in any satisfactory way.

(2) That it will not pay to extract the honey with a view to making a profit, and supply the bees with sugar syrup for winter.

(3) That when feeding has to be resorted to, the strong colonies should be given sufficient comb and stores to cover their own wants and, in addition, supply the weaker colonies with combs of sealed stores.

Moving Bees for Fall Pasture.

Many who are in localities good for clover, thistle, or linden honey, secure little or nothing during the fall of the year. The question has often been asked : Does it pay to move bees to fall pasture? But, so far as I am aware, no one has attempted to follow up such an experiment for a number of years and give results to the public.

When it comes to the cost of moving bees to fall pasture, everyone must make his own estimate. In my case, I found a district in the vicinity of Scotland, nine miles distant, which had a fair amount of buckwheat, but it does not yield so freely there as on lake shores, where heavy dews prevail ; and the locality affords practically no source for boneset and aster honey. The bees were moved the nine miles, and the cost of moving sixteen colonies with supers, both ways, allowing $3 per day for team and man, was $6.

Different strengths of bees were taken, some of which did not cover more than two or three combs, while others filled, not only the brood-chamber of the hive, but the super in addition. Under these circumstances, it will not be a matter of surprise that I have to report a marked difference in the amount of honey gathered by each colony. The weights were taken after the bees were returned to the home apiary ; and, in estimating the gain or loss, allowance must be made for the amount of stores which the bees would have consumed during the 47 days, if left at home with nothing but their stores to draw from. The gains were as follows :

No 1, 112½ lbs.; No. 2, 57½ ; No. 3, 86½ ; No .4, 2 ; No. 5, 49½ ; No. 6, 10 ; No. 7, 49 ; No. 8, 2½ ; No. 9, 62 ; No. 10, 16 ; No. 11, 7½ ; No. 12, 41 ; No. 13, 44; No. 14, 53 ; No. 15, 71 ; No. 16, 42.

This makes a total gain in weight of 706 pounds ; and the bees were undoubtedly put in a better position to winter. The buckwheat flow stopped by the 7th of September ; and a great many young bees bred under the stimulus of the flow, went into winter quarters fully matured.

It will be noticed from the foregoing that the highest result from one colony was 112½ pounds ; the least, two pounds. From one, a good profit was derived ; from the other, little or none, although the colony was doubtless in better shape for winter. As to the value of the crop secured, every one must judge from his own market. In my case, its value was 5cts. per pound, and stored in the combs for winter, it was worth more than that. There is no doubt that many last fall, within easy driving distance of as good a

locality, secured no fall crop, and as a result had to feed their bees during the winter at a considerable outlay of labor and money.

Comb Foundation.

The use of comb foundation has become general; in fact, few if any, keeping bees in the moveable frame hive, attempt to do without it. At present comb honey, owing to the quality of the comb foundation, is not generally of a kind satisfactory to the consumer. Although it is desirable to get a foundation which, when utilized and added to by the bees, gives a comb as thin as the natural one, many claim that comb a trifle heavier, is not noticed by consumers. When, however, the base and bottoms of side walls are materially thickened, and the comb has an artifical appearance, and the wax does not crumble when the comb is broken, the result is that the consumer objects and the objection is intensified by the comparatively harmless nature of the change. Again, comb foundation and wax is wasted in the extra thickness; and this is no small item, as it is generally worth fifty to sixty cents per pound.

In our experiments, observations were taken along various lines—*first*, as to what extent, if any, the bees thin the base and side wall of the various thicknesses and kinds of comb foundation. Measurements were made, whenever possible, of the weight of foundation compared with the number of square feet and the thickness of the base of foundation. Measurements were taken of the comb at the base, the side wall close to the hive, and half an inch up the side wall. The comb was put on ice, to harden it for the purpose of more accurate measurement; and three measurements were taken in this case.

Again, to see just how the bees utilized the comb foundations, three tanks of melted wax were prepared; one was colored with a preparation of Alkanet, another with a preparation of carbon, and the third was pure beeswax, uncolored. The various stages in the manufacture of comb foundation were carried out, giving comb foundation from each tank ten, twelve and fifteen feet square to the pound.

These were placed side by side and drawn out in the upper stories by the bees. It was manifested in various ways that the bees objected to the Alkanet, so this kind was discarded. To the foundation, colored black with the preparation of carbon, the bees did not object. The object in placing foundation made of ordinary wax alongside of the colored, was to make measurements of each kind when drawn out by the bees. The measurements of the colored and uncolored being identical, gave us a basis for the statement that the bees did not object to this preparation; and the method of drawing this out was identical with that of ordinary foundation. The base and lower part of the comb were not as we might expect, of a black color, and the fresh and added wax, white. Instead there is a regular gradation from black at the base to white at the top of the cell. The heavier the foundation, the darker the base and adjoining side wall.

From the above it would appear reasonable to expect that the bees keep adding scales of newly secreted wax and then pulling the side wall, thus decreasing gradually the percentage of colored wax. We also conclude that the quality of wax used in the foundation has an influence, not only on the base, but to a certain extent in almost the entire wall of the cell. The heavier the foundation, the greater the influence on the side wall. Again, notes were taken daily when the bees were beginning to draw out the foundation; and although the heavier foundation was scattered about in the various parts of the upper stories, they gave the preference to the heavier foundation, working on it first. Great caution must, of course, be observed in coming to conclusions. The bees, if the heavier foundation had been taken away, might have been almost as willing to go to work at once upon the lighter grade. At present, no way appears open for conducting a satisfactory experiment to prove anything in this direction. The measurements taken at the base of the wall, and half an inch from the base, all tend to show that the wall is thicker at the base and tapers, becoming thinner at the mouth. So far as I am aware, no one has ever made such measurements.

The "Vandusen" is a flat-bottom (unnatural) foundation. The various specimens of this kind which were put into the sections were partially covered to prevent the bees from

touching the covered portion. The remainder was left to the bees. In every case the bees changed the base from flat-bottom to natural. I have adopted a new method.

In the tables given below, the measurements are one ten-thousandth part of an inch.

Kind.	Base.	Wall at base	Wall $\frac{1}{2}$" up.	Base of foundation before putting in.
(*a*)	72	32	28	107
	70	30	28	105
	70	30	28	104
(*b*)	68	33	28	100
	70	35	28	95
	71	33	28	98
(*c*)	60	30	28	78
	60	29	28	60
	62	30	27	60
(*d*)	51	32	28	Could not get a piece large
	55	30	29	enough to measure.
	54	33	28	
(*e*) *		32	28	230
		30	29	
		31	28	
(*f*) *		30	28	90
		32	28	
		33	28	
(*g*) *		32	30	170
		33	28	
		32	30	
(*h*) *	57			
	50			
	62½			
(*i*)	52	40	38	
	55	42	34	
	55	40	37	

Owing to the smallness of the piece which could be secured free from the base at either side it was impossible in this case to get a reliable measurement. It will be seen that as far, as the base is concerned, the measurements of (*d*) are practically as natural drone comb ; the side wall is even a little thinner. No measurements of the side wall of natural worker comb have been made, and for this reason, the comparison has to be taken with caution, being between a worker side wall, built on Vaudevort foundation 12 ft. square to the pound, and a natural drone comb. The combs (*c*), (*b*), and (*a*) gradually increase in weight. The Vaudevort foundation had a light base but a heavy side wall. In the above specimens of foundation, there is a vast difference in the amount of $4\frac{1}{4}$x$4\frac{1}{4}$ se ction which can be filled by a pound of foundation.

With the four square feet per pound, 36 sections can be filled,
" " $6\frac{1}{2}$ " " " " $58\frac{1}{2}$ " " " "
" " 10 " " " " 90 " " " "
" " 12 " " " " 108 " " " "
" " 15 " " " " 135 " " " "

Upon the market in Canada that which will fill 36 sections costs about fifty cents per pound; and that which will fill 135 sections costs about sixty cents per pound. With the latter nearly four times the number of sections can be filled ; yet the cost per pound is increased only thirty per cent. If only the question of cost of foundation per section had to be considered it would pay best to take the lightest.

*Impossible to measure.

EXPERIMENT WITH FIVE-BANDED ITALIAN BEES.

Five-banded Italian bees have attracted a good deal of attention during the past three years, but the reports as to their merits have been very conflicting. Five queens were purchased, four from a well known Southern breeder and one from a Canadian. The queens were introduced during July and August, 1894; and as there was a sufficient honey flow during the autumn, the bees went into winter quarters in good condition as to numbers. The bees were wintered in the cellar. Cushions and several thicknesses of paper were placed on top of the frames and quilts; otherwise no protection was given. In this respect, the bees were treated the same as ordinary colonies in apiary. One colony, No. 3, perished. On April 4th, 1895, they were taken from the cellar and placed on their summer stands. On Thursday, April 18th, they were working freely on soft maple. About three weeks later they were about at their lowest in numerical strength, and young bees began to emerge freely. The conditions in an eight frame "Langstroth" hive were then as follows:

No. 1. Very weak, having barely two Langstroth combs of bees.

No. 2. Good average strength, having six Langstroth combs of bees.

No. 3. Perished during winter.

No. 4. Very weak, having barely two Langstroth combs of bees.

No. 5. Wintered well, a very strong colony, marking XXXX when placed on summer stand.

The two numbers, one and four, never pulled up, and were not full colonies on July 15th, after the close of the surplus honey flow, which was light. Number five, which, when examined in spring, was one of the strongest colonies in the apiary, for some reason remained without an upper story—a good full colony. It gathered sufficient for its own immediate requirements, and on Oct. 17th, weighed thirty-seven pounds, which, after allowing for weight of hive, comb, and bees, gives it about twelve pounds of honey, which is not sufficient for winter. The colony never offered to swarm. The queen appeared prolific, but the bees were short-lived. Further, I noticed that the five-banded bees were amongst the most active in the apiary; they never missed a chance to rob, and I formed the opinion that they were of such nervous development that their vitality was quickly exhausted, and the bees were short-lived, the strength of the colony being exhausted by their movements. Touching the winter question, one has to be exceedingly careful not to come to hasty conclusions; but last winter's reports would tend to show that these bees are not good winterers. It is true that the season was not a good one; but the fact that they secured no surplus, while others in the apiary secured as high as eighteen and twenty-two pounds of comb honey, does not say very much for the five-banded Italians.

The bees were gentle while the colony was in a normal condition; but the two weakest colonies, which, according to my usual practice, I re-queened, were exceedingly cross when queenless. The fact that the two weakest colonies gained strength very slowly, should not be recorded against the five-banded bees. With colonies poorly wintered, it is likely that the queen suffers as well as the bees; and, if this is correct, it would explain the condition. The following are the deductions:

1st. They are below the average as to wintering qualities.

2nd. They are short-lived, probably because of a high strung temperament.

3rd. They are prolific.

4th. They are gentle, unless when queenless.

5th. They are inclined to rob.

In conclusion, I may say that the Ontario Agricultural and Experimental Union also conducted co-operative experiments with these bees. Nine successful experiments were made, and, with the exception of one experiment, the above results are endorsed. Two report, in addition to the above, that the bees have a difficulty in locating themselves and are inclined to get into hives of other bees. I did not observe this during the past year; but in 1896 I will place the five-banded colonies between darker bees and will take observations in this direction.

Respectfully submitted,

R. F. HOLTERMANN,

Lecturer on Apiculture.

BRANTFORD, Dec. 31st., 1895.

PART XIV.

REPORT OF THE PHYSICIAN.

To the President of the Ontario Agricultural College :

SIR,—Permit me to present to you my second annual report.

The general health of the College for the past year has been good. We have had no cases of very severe illness. During the winter and spring a number of the students and servants suffered from influenza, from which all recovered without any complications or sequels. A few slight accidents occurred.

With the Dairy School, I regret to say that our experience was not so fortunate. The course opened on January 14th, with a very large class in attendance. Among these, one young man came complaining of the initial symptoms of an illness which, shortly after his arrival, proved to be smallpox. He was sent to the smallpox hospital in the city. All the students and others connected with the Dairy School and College were immediately vaccinated. Those attending the Dairy School were quarantined in the dairy buildings, and the College students in the gymnasium. The College building was thoroughly disinfected. Before being discharged from quarantine, the students took disinfectant baths, put on fresh clothing, and left behind the clothes and bed clothing used by them during quarantine, for disinfection in a steam sterilizer provided for the purpose. The buildings were thoroughly disinfected. The course in the College and Dairy School was resumed, and continued without interruption by the occurrence of other cases among the students.

At the opening of the present College term, the students were carefully examined The requirements of the by-laws have been carefully observed during the year. The sanitary condition of the College is good.

Respectfully submitted,

WM. O. STEWART.

GUELPH, ONT., December 31, 1895.

APPENDIX I.

GRADUATES, ASSOCIATES AND COLLEGE ROLL

1. Graduates.

Bachelors of the Science of Agriculture, Degree of B.S.A.

University of Toronto.

1893—Beckett, H. L.
1893—Bell, L. G.
1890—Brodie, G. A.
1894—Brown, W. J.
1891—Buchanan, D.

1892—Carlyle, W. L.
1895—Christian, A. H.
1891—Cowan, J. H.
1888—Craig, J. A.
1893—Crealy, J. E.
1888—Creelman, G. C.

1893—Day, G. E.
1890—Dean, H. H.
1895—Doherty, M. W.
1893—Dyer, W. D.

1893—Eaton, L. W.

1888—Fee, J. J.
1894—Ferguson, J. J.
1891—Field, H.

1892—Gibson, D. Z.

1894—Graham, W. R.

1893—Harcourt, Robt.
1889—Harcourt, G.
1892—Harrison, F. C.
1891—Hewgill, E. A. (*ob.*)
1891—Hutt, H. L.
1889—Hutton, J. R.
1892—Hutchinson, J. W.

1894—Kennedy, P. B.
1895—Kennedy, W. A.
1895—King, A. A.

1889—Lehmann, A.
1891—Linfield, F. B.

1892—Marsh, G. F.
1890—McCallum, W.
1894—McCallum, Wm.
1890—Monteith, S. N.
1889—Morgan, J. H. A.
1892—Morgan, R. N.

1892—Newcomen, W. F.

1891—Palmer, W. J.
1888—Paterson, B. E.

1889—Raynor, T.
1895—Robertson, G. A.
1895—Rowe, G. F.

1890—Shantz, A.
1891—Sharman, H. B.
1893—Shaw, R. S.
1891—Sleightholm, J. A. B.
1894—Sleightholm, F. J.
1894—Spencer, J. B.
1893—Story, H.
1889—Soule, R. M. (*ob.*)
1893—Soule, A. M.

1895—White, E. F.
1891—Whitley, C. F.
1895—Wiancko, A. T.
1895—Widdifield, J. W.

1888—Zavitz, C. A.

2. Associates.

The total number of Associates up to the present time is 309, as follows:

1888—Austin, A. M.
1880—Anderson, J.
1880—Ash, W. E.
1893—*Atkinson, Jas.
1892—Aylesworth, D.

1881—Ballantyne, W. W.
1879—Bannard, E. L.
1888—Bayne, S. R. S.
1892—†Beckett, H. L.
1892—Bell, L. G.
1888—Birdsall, W. G.
1888—Bishop, W. R.
1889—*Brodie, G. A.

1890—Brown, H. H.
1892—Brown, B. C.
1890—Buchanan, D.
1894—Buchanan, Jno.
1888—Budd, W.
1885—‡Butler, G. C.
1884—Black, P. C.
1882—Blanchard, E. L.
1886—Broome, A. H.
1886—‡Brown, C. R.
1888—Brown, S. P.
1893—Brown, W. J.
1892—Burns, J. A. S.
1893—Burns, J. H.

1886—Calvert, S.
1890—Campbell, C. S.
1877—Campbell, J. A.
1880—Campbell, D. P. L.
1895—Campbell, W. G.
1892—Carlaw, W.
1891—Carlyle, W. L.
1884—*Carpenter, P. A. (*ob.*)
1888—Carpenter, W. S.
1892—Carpenter, F. C. S.
1894—Carrick, C. S.
1895—Cass, L. H.
1895—Chadsey, G. E.
1886—Cobb, C.

* Gold Medallist. † First Silver Medallist. ‡ Second Silver Medallist.

ASSOCIATES.—*Continued.*

1889—Chapman, R. K.
1882—Charlton, G. H.
1882—Chase, O.
1894—Christian, A. H.
1879—Clark, J.
1895—*Clark, J. F.
1879—Clinton, N. J.
1880—Clutton, A. H.
1894—Cook, J. H.
1893—Cooper, W. W.
1893—Conn, Joseph.
1890—Cowan, J. H.
1890—‡Cowan, R. E.
1887—Craig, J. A.
1892—Crealy, J. E.
1887—Creelman, G. C.
1878—Crompton, E.

1878—Davis, C. J.
1880—Dawes, M. A.
1882—Dawson, J. J.
1892—*Day, G. E.
1888—†Dean, H. H.
1893—Dean, Fred.
1882—Dennis, J.
1889—Derbyshire, J. A.
1881—Dickenson, C. S.
1894—Doherty, M. W.
1890—Dolsen, W. J.
1887—Donald, G. C.
1887—Donaldson, F. N.
1877—Douglas, J. D.
1894—Duffett, G. P.
1877—Dunlop, S.
1895—Dunn, E.
1892—Dyer, W. D.

1892—Eaton, L. W.
1895—Edelsten, E. J. M.
1890—Elliott, R.
1894—Elliott, Wm.
1893—Elmes, W. A.
1888—Elton, C. W.
1888—Elton, R. F.
1882—Elworthy, R. H.
1887—Ewing, W.

1890—Fairbairn, O. G.
1878—Farlinger, W. K.
1886—Fee, J. J.
1893—Ferguson, J. J.
1890—Field, H.
1881—File, J.
1882—Fotheringham, J.
1883—‡Fotheringham, W.
1879—Fyfe, A.

1883—Garland, C. S.
1889—Gelling, J. A.
1892—Gies, N.
1891—*Gibson, D. Z.
1887—Gilbert, W. J. (*ob.*)
1879—Gillespie, G. H.
1892—Graham, W. R.
1878—Graham, D.
1879—Greig, G. H.
1881—Grindlay, A. W.

1890—Hadwen, G. H.
1891—Haight, W. L.
1882—Hallesy, F.
1893—Hamilton, C. A. W.
1892—Harcourt, R.
1888—*Harcourt, G.
1890—†Harcourt, J.
1887—Harkness, A. D.
1891—Harrison, F. C.
1888—Harrison, R. E.
1887—Hart, J. A.
1887—Hart, J. W.
1892—Harvey, W. H.
1888—Heacock, F. W.
1894—Henderson, R. H.
1890—Hewgill, E. A. (*ob.*)
1894—High, A. M.
1890—Holliday, W. B.
1886—Holtby, R. M.
1880 Holtermann, R. F.
1892—Honsberger, J. D.
1882—Horne, W. H.
1888—Horrocks, T. J.
1887—Howes, J. S.
1882—Howitt, W.
1892—Hurley, T. J.
1893—Husband, E. M.
1890—*Hutt, H. L.
1888—Hutton, J. R.

1886—Idington, F. S.

1886—Jeffrey, J. S.
1883—Jeffs, H. B.
1879—Jopling, W.

1894—Kennedy, W. A.
1893—Kennedy, P. B.
1894—Kidd, D. F.
1894—King, A. A.
1895—Kipp, A.
1895—Knight, J. W.
1888—Knowlton, S. M.

1894—Lailey, F. T.
1894—Laird, J. G.
1882—Landsborough, J.
1895—†Lang, L. W.
1887—Leavens, D. H.
1893—Lehmann, R. A.
1884—‡Lehmann, A.
1887—‡Lick, E.
1877—Lindsay, A. J.
1889—‡Linfield, F. B.
1887—Livesey, E. M.
1880—Lomas, J. W.
1878—Logan, T.

1880—Macaulay, H.
1890—Macfarland, T. W. R.
1885—Macpherson, A.
1886—*Madge, R. W.
1882—Mahoney, E. C.
1884—Major, C. H.
1889—Marsack, F.
1889—Marsack, H. A.
1891—Marsh, G. F.
1877—Mason, T. H.
1890—McKergow, J. G.
1877—Myer, G. W.
1887—Morgan, J. H. A.
1881—Motherwell, W. R.
1885—†Muir, J. B.
1895—McCallan, E. A.
1887—McCallum, E. G.
1893—‡McCallum, W.
1889—McCallum, W.
1895—Maconachie, G. R. B.
1893—McCrimmon, W. D.
1895—McCullough, H. A.
1889—McEvoy, T. A.
1895—McGillivray, J. W.
1885—McIntyre, D. N.
1885—McKay, J. B.
1886—McKay, J. G.
1893—McKenzie, W. G.
1891—McKenzie, A. G.
1889—McLaren, P. S.
1893—McMordie, R.
1893—McNaughton, K.
1895—McPhail, J. D.
1883—McPherson, D.
1890—Monk, W. D.
1889—Monteith, S. N.
1891—*Morgan, R. N.
1890—Mulholland, F.

1878—Nasmith, D. M
1891—Newcomen, W. F.
1879—Nichol, A. (*ob.*)
1882—Nicol, G.
1882—Notman, C. R.

1877—O'Beirne, A. C.
1887—Orsman, C. P.
1886—Owen, W. H.

1888—Palmer, W. J.
1887—Paterson, B. E.
1895—‡Paterson, T. F.
1895—Payne, G. Y.
1883—Perry, D. E.
1891—Perry, E. C.
1893—Phin, A. E.
1881—§Phin, R. J.
1881—Phin, W. E.
1881—Pope, H.
1886—Power, R. M.
1884—Powys, P. C.

1882—‡Ramsay, R. A.
1879—Randall, J. R.
1885—*Raynor, T.
1885—Reid, P.
1894—Reinke, C. E.
1889—Randall, W.
1889—Rennie, E. A.
1883—*Robertson, W.
1879—Robertson, J.
1894—Robertson, G. A.
1881—Robins, W. P.
1879—Robinson, C. B.
1893—Roper-Curzon, A.C.H.
1892—Roper-Curzon, S.
1881—Ross, J. G.
1894—Rowe, G. F.
1892—Ruthven, W. A.

1884—Saxton, E. A.
1888—Serson, W. E.
1892—*Shaw, R. S.
1888—Sinclair, J. J.
1882—Silverthorne, N.
1894—Simpson, A. E.
1892—Soule, A. M.
1888—Soule, R. M (*ob.*)
1877—Sykes, W. J.
1883—Schwartz, J. A.

* Gold Medallist. † First Silver Medallist. ‡ Second Silver Medallist.
§ Winner of the Governor-General's Medal—the only medal given that year.

ASSOCIATES.—*Concluded.*

1887—†Scrugham, J. G.
1888—Shantz, A.
1887—Sharman, H. B.
1887—Shaw, G. H.
1882—†Shuttleworth, A. E.
1892—Silverton, C.
1884—†Slater, H. (*ob.*)
1887—*Sleightholm, F. J.
1890—Sleightholm, J. A. B.
1885—Smith, E. P.
1895—Smith, G. A.
1895—Smith, P. B.
1894—Smyth, F. L.
1892—‡Soule, A. M.
1891—Sparrow, J. C. H.
1893—Spencer, J. B.
1891—Spencer, W. A.
1884—Steers, O.
1888—Stevenson, C. R.
1893—Stewart, J.
1878—Stewart, W.
1892—Story, H.
1882—Stover, W. J.
1886—†Sturge, E.
1888—Sweet, H. R.

1895—Taylor, W. H.
1891—Thompson, R. A
1895—Thompson, W. J.
1889—‡Tinney, T. H.
1892—Tolton, J. E.
1879—Toole, L.
1883—Torrance, W. J.
1884—Tucker, H. V.
1895—Tye, C. W.
1885—Thompson, W. D.

1888—Valance, R. (*ob.*)

1894—Vipond, J. M.

1879—Warnica, A. W.
1884—Wark, A. E.
1878—Warren, J. B.
1890—Webster, F. E.
1880—§Webster, J. L.
1879—Wells, C.
1890—Wells, E.
1882—Wettlaufer, F.
1894—*Wheatley, Jno.

1895—Whetter, J. R
1891—White, E. F.
1892—Wiancko, A. T.
1894—Widdifield, J. W.
1891—†Wilkin, F. A.
1879—Wilkinson, J. P.
1888—Willans, T. B.
1888—Willans, N.
1879—Willis, J.
1883—Willis, W. B. (*ob.*)
1888—Wilmott, A. B.
1895—Wilson, A. C.
1890—Wilson, F. G.
1894—Wilson, E. E.
1895—Wilson, N. F.
1882—White, C. D.
1879—White, G. P.
1890—Whitley, C. F.
1890—Wood, W. D.
1884—Wroughton, T. A.

1892—Yuill, A. R.

1886—Zavitz, C. A.

* Gold Medallist † First Silver Medallist. ‡ Second Silver Medallist.
§ Winner of the Governor-General's Medal—the only medal given that year.

3. COLLEGE ROLL FOR 1895.

Third Year Students.

Name.	P. O. Address.	County, etc.
Atkinson, Jas	Egmondville	Huron, Ont.
Bishop, W. R	Beachville	Oxford, Ont.
Christian, A. H	Guelph	Wellington, Ont.
Clark, J. F	Bay View	Prince Edward Island.
Doherty, M. W	Eglinton	York, Ont
Kennedy, W. A	Apple Hill	Glengarry, Ont.
Kidd, D. F	Cookstown	Simcoe, Ont.
King, A. A	Johnson's Crossing	Colchester Co., N.S.
Knight, J. W	Elginburg	Frontenac, Ont.
Lailey, F. T	Toronto	York, Ont.
Maconachie, G. R. B	Gurdaspur	Punjab, India.
Paterson, T. F	Lucknow	Bruce, Ont.
Robertson, G. A	Kingston	Frontenac, Ont.
Rowe, G. F	London	England.
Smith, G. A	Morrisburg	Dundas, Ont.
Smith, P. B	Hamilton	Bermuda.
Thompson, W. J	Barrie	Simcoe, Ont.
White, E. F	Clarksburg	Grey, Ont.
Winacko, A. T	Sparrow Lake	Muskoka, Ont.
Widdifield, J. W	Siloam	Ontario, Ont.
Wilson, A. C	Greenway	Huron, Ont.
Wilson, N. F	Rockland	Russell, Ont.

College Roll for 1895.

Second Year Students.

Name.	P. O. Address.	County, etc.
Bell, T. C	Cataract	Peel, Ont.
Brickwell, J. R	Paris	France.
Butler, W. E	Dereham Centre	Oxford, Ont.
Campbell, A	Dalmeny	Russell, Ont.
Cass, L. H	L'Orignal	Prescott, Ont.
Campbell, W. G.	Brantford	Brant, Ont.
Chadsey, G. E	Sumas	British Columbia.
Charlton, E. S	St. George	Brant, Ont.
Cousins, R. J	Enterprise	Addington, Ont.
Cunningham, J	Ardtrea	Simcoe, Ont.
Devitt, I. I	Floradale	Waterloo, Ont.
Dunn, E	Plover Mills	Middlesex, Ont.
Edelsten, E. J. M	London	England.
Farrer, J. W	Parry Sound	Parry Sound District, On
Gadd, T. T	Varney	Grey, Ont.
Gamble, Wm	Cumberland	Russell, Ont.
Guy, J. T	Columbus	Ontario. Ont.
Higginson, G. O	Hawkesbury	Prescott, Ont.
Hodgetts, P. W	St. Catharines	Lincoln, Ont.
Hutton, H	Toledo	Leeds, Ont.
Kennedy, A	Limehouse	Halton, Ont.
Kewley, H. D	Sarnia	Lambton, Ont.
Kipp, A	Chilliwack	British Columbia.
Lang, L. W	St Marys	Perth, Ont.
Leavitt, A. S	Vankleek Hill	Prescott, Ont.
Loghrin, S. M	Stratford	Perth, Ont.
Morgan, G. W	Kerwood	Middlesex, Ont.
McCallan, E. A	St. David's	Bermuda.
McCullough, H. A	Nantve	Simcoe, Ont.
McDougall, D. H	Martintown	Glengarry, Ont.
McDonald, J. C	Lucknow	Huron, Ont.
McGillivray, J. W	Sumas	British Columbia.
Maclennan, J. F	Owen Sound	Grey, Ont.
McPhail, J. D	Vernon	Carleton, Ont.
Macpherson, D. J	Lancaster	Glengarry, Ont.
Nasmith, Jno	Toronto	York, Ont.
Oastler, J. R	Featherston	Parry Sound District, Ont.
Parker, F. A	Bowmanville	Durham, Ont.
Payne, G. Y	Peterborough	Peterborough, Ont.
Ponting, E. A	Moweaqua	Illinois, U. S. A.
Robertson, T. H	Kingston	Frontenac, Ont.
Rogers, C. H	Grafton	Northumberland, Ont.
Sissons, F. J. S	Barrie	Simcoe, Ont.
Stoddart, R. L	Bedford	England.
Taylor, W. H	Peterborough	Peterborough, Ont.
Thom, W. E	Morrisburg	Dundas, Ont.
Tye, C. W	Haysville	Waterloo, Ont.
Whetter, J R	Lorneville	Victoria, Ont.
Wilson, A. F	McGarry	Lanark, Ont.

College Roll for 1895.

First Year Students.

Name.	P. O. Address.	County, etc.
Allison, D. H	Adolphustown	Lennox, Ont.
Arms, W. L	Randolph	Wisconsin, U.S.A.
Balfour, T. B	Amherstburg	Essex, Ont.
Bard, A. L	Bardsville	Muskoka, Ont.
Beam, E	Black Creek	Welland, Ont.
Benning, Jas	Williamstown	Glengarry, Ont.
Black, G. W	Winchester	Dundas, Ont.
Bourassa, H	St. Hubert	Chambly Co., Que.
Burk, H. W	Amherstburg	Essex, Ont.
Christy, E. V	Bloomfield	Prince Edward, Ont.
Craig, R. D	Guelph	Wellington, Ont.
Davis, A. N	Cayuga	Haldimand, Ont.
Elliott, W. J	Seaforth	Huron, Ont.
Fairweather, T. H	Alma	Wellington, Ont.
Fierheller, E. E	Mount Elgin	Oxford, Ont.
Findlay, J	Toronto	York, Ont.
Geddes, M. D	Midlothian	Parry Sound District, Ont.
Gibson, T. F. E	Toronto	York, Ont.
Gilbert, S	Dublin	Ireland.
Gooch, G. E	Toronto	York, Ont.
Harkness, R. E. L	Irena	Dundas, Ont.
Heartz, W. B. G	Truro	Nova Scotia.
Harris, M. E	Brantford	Brant, Ont.
Irving, J. C	Vernon River Bridge	Prince Edward Island.
Johnston, A. C	Winchester	Dundas, Ont.
Kennedy, J. A	Nassagaweya	Halton, Ont.
King, C	Guelph	Wellington, Ont.
Leggatt, Jas	Mitchell	Perth, Ont.
Leishman, J. E. B	New Lowell	Simcoe, Ont.
Lewes, Geo	Ballymote	Middlesex, Ont.
Lloyd, Jones T	Burford	Brant, Ont.
Lucas, W. T	Bailieboro'	Northumberland, Ont.
Mather, J. W	New Lowell	Simcoe, Ont.
Mills, E. E	Yarmouth Centre	Elgin, Ont.
Milson, W. G	Goring	Grey, Ont.
Moffatt, T	Morewood	Dundas, Ont.
Mooney, John	Inverness	Megantic Co., Que.
McCalla, ——	St. Catharines	Lincoln, Ont.
McCready, J	Harriston	Wellington, Ont.
Macdonald, A. W	Oakville	Halton, Ont.
McDonald, J. D	Lancaster	Glengarry, Ont.
McKenzie, M. A	Thornton	Simcoe, Ont.
McLaughlin, F. G	Stroud	Hants, England.
McMaster, E. B	Toronto	York, Ont.
McMillan, M. J	Newmarket	York, Ont.
McPhail, D. J	Vernon	Dundas, Ont.
Nicholson, Geo	Montreal	Quebec.
Pearson, T. E	Weston	York, Ont.
Pugh, S. H	Milverton	Perth, Ont.
Ratcliffe, A. G	Anderson	Perth, Ont.
Ratcliffe, J. N	Anderson	Perth, Ont.

College Roll for 1895.

First Year Students.—Continued

Name.	P. O. Address.	County, etc.
Reade, J. M	Toronto	York, Ont.
Reinke, B. F	Ancaster	Wentworth, Ont.
Richardson, E. L	Winnipeg	Manitoba
Robertson, Geo	Ottawa	Carleton, Ont.
Roblin, D	Adolphustown	Lennox, Ont.
Ross, M. N	Stirling	Scotland.
Ross, N. M	Stirling	Scotland.
Ross, H. R	Gilead	Hastings, Ont.
Rathwell, W	Ferguson's Falls	Lanark, Ont.
Selwyn, A. L. H	Boscombe	Hampshire, Eng.
Shields, W. M	Glasgow	Scotland.
Squirrell, W. J	Guelph	Wellington, Ont.
Stainton, J. W	Taunton	Durham, Ont.
Stewart, D	Snake River	Renfrew, Ont.
Stovel, H. R	Toronto	York, Ont.
Strong, A	Tilbury Centre	Essex, Ont.
Thomas, Jas	Woodville	Victoria, Ont.
Waddy, P. H	Rosseau	Parry Sound District, Ont.
Weldon, R. G	Halifax	Nova Scotia.
Whigham, R. D	London	England.
West, A. W	Shelley Bay	Bermuda.
Wiancko, T. A	Sparrow Lake	Muskoka, Ont.
Wilkes, W. A	Toronto	York, Ont.
Winchester, G. H	Toronto	York, Ont.
Woodcock, R. H	Southport	Lancashire, Eng.
Yuill, J. J	Carleton Place	Lanark, Ont.
	Specialists.	
Gardiner, H	Morpeth	Kent, Ont.
Moore, W. B	Kingston	Frontenac, Ont.

Total number in general course 150

4. Dairy Students.

Name.	P. O. Address.	County, etc.
Abbott, R. C	Lakefield	Peterborough.
Aiken, R. J	Princeton	Oxford, Ont.
Arkell, H. C	Teeswater	Bruce, Ont.
Armstrong, W. M	Guelph	Wellington, Ont.
Baird, A. K	Motherwell	Perth, Ont.
Beavis, A. H	Dunsford	Victoria, Ont.
Biggin, E. O	Vernon	Trulbull Co., Ohio.
Blayney, J. E	Lynnville	Norfolk, Ont.
Boyd, D	Manotick	Carleton, Ont.
Boyes, F	Nilestown	Middlesex, Ont.
Bradley, R. W	Manotick	Carleton, Ont.
Campbell, A	Thedford	Lambton, Ont.
Campbell, Miss E. M	Dalkeith	Glengarry, Ont.
Carlaw, Geo	Warkworth	Northumberland, Ont.
Carson, W. J	Metcalfe	Carleton, Ont
Carter, J. G	Guelph	Wellington, Ont.
Carter, W. E. C	Toronto	York, Ont
Chalmers, A	Monkton	Perth, Ont.
Christie ——	Winchester	Dundas, Ont.
Clute, J. A	Sillsville	Lennox, Ont.
Code, B	Burritt's Rapids	Leeds, Ont.
Comba, W	Gordonville	Wellington, Ont.
Coomber, H	Port Elgin	Bruce, Ont.
Copeland, J. W	Eastwood	Oxford, Ont.
Conroy, W. J	Cornwall	Stormont, Ont.
Cowieson, W. R	Queensville	York, Ont.
Curtis, W	Newmarket	York, Ont.
Dean, F	Harley	Brant, Ont.
Dennis, R. B	Newmarket	York, Ont.
Dixon, T. S	Lunenburg	Stormont, Ont.
Duncan, R. C	Buttonville	York, Ont.
Elliott, A. T	Bluevale	Huron, Ont.
Elliott, Wm	Galt	Waterloo, Ont.
Everts, M. W	Easton's Corners	Grenville, Ont.
Gardiner, R. M	Valetta	Kent, Ont.
Gibbs, A	Cheapside	Haldimand, Ont.
Goodale, Miss E	Milverton	Perth, Ont.
Graesser, F. A	Llangollen	North Wales.
Graham, G. A	Westwood	Peterborough, Ont.
Hamilton, C. A. W	Guelph	Wellington, Ont.
Heeks, H	Palermo	Halton, Ont.
Henrick, K. A	Headford	York, Ont.
Hill, G. W	Summerhill	Huron, Ont.
Hill, Jas. A	Conway	Lennox, Ont.
Humphrey, Geo	Norval	Halton, Ont.
Irvine, D. A	Dalkeith	Glengarry, Ont.
James, D. A	Nilestown	Middlesex, Ont.
Jackson, Miss L	Petrolia	Lambton, Ont.
Jeffs, C. B	Bond Head	Simcoe, Ont.
King, R. B	Johnson's Crossing	Nova Scotia.
Laird, J. G	Sarnia	Lambton, Ont.
Marquette, G. W	Van Camp	Dundas, Ont.
Marsh, G. F	Thornbury	Grey, Ont.
Marshall, T. B	Princeton	Oxford, Ont.
Matthews, A. F	Denfield	Middlesex, Ont.

DAIRY STUDENTS.—*Continued.*

Name.	P. O. Address.	County, etc.
Malcolm, Robt	Kinlough	Bruce, Ont.
Medd, W. G.	Constance	Huron, Ont.
Metcalfe, G.	Norwood	Peterborough, Ont.
Millar, J. F	Brantford	Brant, Ont.
Mitchell, H	Keswick Ridge	York Co., N.B.
Mitchell, W. H	Lennoxville	Quebec.
McCallum, L. C	Guelph	Wellington, Ont.
McDonald, T. W	Caledon, East	Peel, Ont.
McDonald, W. J	Ormond	Dundas, Ont.
McDonagh, O. E	Kettleby	York, Ont.
McGarry, W. R	McGarry	Lanark, Ont.
McPherson, A. D	Tayside	Stormont, Ont.
McQuillan, J. J	Guelph	Wellington, Ont.
Papineau, P. C	Constance	Huron, Ont.
Parker, A. A	Rockford	Norfolk, Ont.
Parker, Mrs. E	Puslinch	Wellington, Ont.
Purdy, W. O	Rockdale	Peterborough, Ont.
Ragsdale, W. J	Almonte	Carleton, Ont.
Reist, E. B	Heidelberg	Waterloo, Ont.
Rendall, Wm	Camperdown	Grey, Ont.
Richardson, D	Vandecar	Oxford, Ont.
Robeson, J	Athens	Leeds, Ont.
Ross, E. B	Iroquois	Dundas, Ont.
Ross, W. A	Brucefield	Huron, Ont.
Sharpe, A. W	Mount Forest	Wellington, Ont.
Shorey, S. C	Sandhurst	Lennox, Ont.
Scott, J. H	Cromarty	Perth, Ont.
Singleton, W. M	Newboro'	Leeds, Ont.
Smith, E. P	Chilliwack	British Columbia.
Smith, H	Clarence	Russell, Ont.
Smythe, F. L	Tormore	York, Ont.
Stillman, R	Campbellford	Northumberland, Ont.
Stonehouse, J	Port Perry	Ontario, Ont.
Storey, H. E	Cobourg	Northumberland, Ont.
Stevenson, A	Clayton	Lanark, Ont.
Swartz, W. J	Aylmer	Elgin, Ont.
Taber, F. W	Little York	York, Ont.
Tucker, G. E	Clarence	Russell, Ont.
Travis, C	Acacia	Norfolk, Ont.
Travis, F	Staffordville	Elgin, Ont.
Traviss, C. H	Holt	York, Ont.
Waddell, Wm	Kinloss	Bruce, Ont.
Weir, Wm	Lang	Peterborough, Ont.
Westphall, A. A	Nelson	Halton, Ont.
Young, Robt	Stouffville	Ontario, Ont.

Total number in Dairy Course ..... 100.

APPENDIX II.

SYLLABUS OF LECTURES.

Lectures began as usual on the 1st October, 1893, and continued, with the omission of the Christmas vacation, until the 30th June, 1894, which latter date was the end of the scholastic year 1893-94.

The following syllabus of lectures will convey some idea of the class-room work done by the several professors in the nine months just mentioned.

FIRST YEAR.

Fall Term —1st October to 22nd December.

Agriculture

Introductory. Ancient and modern agriculture; agricultural literature; different systems of farming; history of agriculture.

Soils. Their formation and composition, physical and chemical properties, etc.; examination and classification of soils; cultivation of soils, including various tillage operations—plowing, harrowing, cultivating, rolling, etc.

Land Drainage. Method of laying out drains; various kinds of drains and their construction; different modes of draining.

Rotation of Crops. Importance and necessity of rotation; principles underlying it; rotations suitable to different kinds of soil; examination and criticism of different systems of rotation.

Cattle. Pointing out and naming the different parts of the animal; characteristic points and peculiarities of the principal beef and dairy breeds of cattle; practical handling of beef and dairy animals.

Natural Science.

Chemical Physics. Matter; accessory and essential properties of matter; attraction; various kinds of attraction—cohesion, adhesion, capillary, electrical and chemical; specific gravity; weights and measures; heat, measurement of heat, thermometers, specific and latent heat; sources, natures and laws of light.

Inorganic Chemistry. Scope of subject; elementary and compound substances; chemical affinity; symbols; nomenclature; combining proportions by weight and by volume; atomic theory; atomicity and basicity; oxygen and hydrogen; water—its nature, functions, decomposition and impurities; nitrogen; the atmosphere—its composition, uses and impurities; ammonia—its sources and uses; nitric acid and its connection with plants.

Human Physiology and Hygiene. Description of the different tissues of the body; alimentary system; circulatory system; nervous system; importance of ventilation and the influence of food on the body; remarks on the proper care of the body and attention to its surroundings in order to keep it in a continual state of health.

Zoology. Distinction between animate and inanimate objects; distinction between plants and animals; basis of classification of animals; leading character of each subkingdom, with special reference to classes of animals connected with agriculture.

Veterinary Science.

Anatomy and Physiology of the horse, ox, sheep and pig; osseous system, muscular system, syndesmology, plantar system, and odontology.

ENGLISH.

Composition. Review of grammar, with exercises on capital letters and punctuation.

Literature. Selections from Palgrave's Golden Treasury and Addison.

MATHEMATICS.

Arithmetic. Review of subject, with special reference to methods, decimals, interest, discount, general problems.

Bookkeeping. Subject commenced.

Winter Term.—22nd January to 16th April.

AGRICULTURE.

Manures. Composition, management, and application of farmyard manure; artificial fertilizers—their composition, uses, and modes of application; mechanical and chemical effects of manures on various kinds of soil and crops; the amounts to apply, etc.; green manures.

Crops for Soiling. The advantages of soiling; the principal soiling crops; feeding of green crops to live stock.

The Weeds of the Farm. The most troublesome weeds described, and different modes of eradicating them.

Sheep. Characteristic points of medium and lon wool breeds, and practical handling of same.

NATURAL SCIENCE.

Inorganic Chemistry (Continued) Carbon; combustion; carbonic acid and its relation to the animal and vegetable kingdom; sulphur and its compounds; manufacture, land uses of sulphuric acid; phosphorous; phosphoric acid and its importance in agriculture; chlorine—its bleaching properties; bromide; iodine; silicon; potassium; calcium; magnesium; iron, etc.

Organic Chemistry. Constitutions of organic compounds; alcohols; aldehydes, acids and their derivatives; formic, acetic, oxalic, tartaric, citric, lactic, malic, uric, and tannic acids. Constitution of oils and fats—saponification; sugars, starch, cellulose; albuminoids, or flesh formers, and their allies; essential oils; alkaloids—morphine and quinine; classification of organic compounds.

Zoology (Continued). Sub-kingdoms further described; detailed account of some injurious parasites, such as "liver-fluke," "tape-worm," "trichina," etc; insects—their influence on plant life; corals and mollusks as agents in the formation of soil; vertebrates, with special reference to those of importance in the economy of the farm.

Lectures illustrated by specimens and diagrams.

VETERINARY SCIENCE.

Veterinary Anatomy. Anatomy and physiology of the horse, ox, sheep and pig—digestive system, circulatory system, respiratory system, urinary system, nervous system, sensitive system, generative system, tegumental system.

ENGLISH.

Composition. Exercises continued; letter writing, etc.

English Classics. Critical study of selections from Palgrave continued, with selections from Irving's Sketch Book.

MATHEMATICS AND BOOKKEEPING.

Arithmetic. Equation of payments; percentage; profit and loss; mensuration.

Bookkeeping. Business forms and correspondence; general farm accounts; dairy, field and garden accounts.

Spring Term.—17th April to 30th June.

Agriculture.

Preparation of soil. Modes of preparation for different crops, and various kinds of soil.

Seeds and Sowing. Testing the quality of seed; changing seed; quantity per acre; and methods of sowing.

The Crops of the Farm. Their growth and management—hay, rye, wheat, barley, oats, peas, buckwheat, potatoes, turnips, mangels, sugar beets, rape, etc.

Pastures. Growth and management of pastures; temporary and permanent pastures.

Feeding of Live Stock. General outline of the principles of feeding different kinds of stock.

Natural Science.

Geology. Connection between geology and agriculture; classification of rocks—their origin and mode of formation, changes which they have undergone after decomposition; fossils—their origin and importance; geological periods and characteristics of each.

Geology of Canada, with special reference to the nature and economic value of the rock deposits; glacial period and its influence on the formation of soil.

Lectures illustrated by numerous specimens and designs.

Botany. Full description of seed, roots, stem, leaves, and flower. Plants brought into the lecture room and analyzed before the class, so as to render students familiar with the different organs and their use in the planet economy.

Lectures illustrated by excellent diagrams.

Veterinary Science.

Materia Medica. The preparation, doses, action, and use of about one hundred of the principal medicines used in veterinary practice.

English.

English Grammar and Composition. Authorized Grammar.

English Classics. Critical study of selections from Palgrave and Irving.

Mathematics.

Mensuration. Mensuration and surfaces—the square, rectangle, triangle, trapezoid, regular polygon, circle. Special application to the measurement of lumber. Mensuration of solids; special application to the measurement of timber, earth, etc.

SECOND YEAR.

Fall Term.—1st October to 22nd December.

Agriculture.

Cattle. Origin and history of the leading breeds of cattle in America; beef breeds—their leading characteristics and principal points: dairy breeds—their leading characteristics and principal points; practical handling and judging of cattle.

Natural Science.

Agricultural Chemistry. Connection between chemistry and agriculture; the various compounds which enter into the compositions of the bodies of animals; the chemical changes which food undergoes during digestion; chemical changes which occur during the decomposition of the bodies of animals at death; the functions of animals and plants contrasted; food of plants, and whence derived; origin and nature of soils; classification of soils; causes of unproductiveness in soil and how detected; preservation, improvement and renovation of soils; manures classified; the chemical action of manures on different soils; commercial valuation of fertilizers.

HORTICULTURE.

Fruit Growing.

Introduction. Brief history of horticulture; extent and importance of the industry; Ontario as a fruit-growing country; the outlook for the fruit industry; requisites for the business.

Leading Principles in the Growth of Trees. Description and function of roots, stems, branches, buds, leaves, flowers, fruit and seeds. Illustrated by specimens in the class room.

Production of New Varieties. Species and varieties; natural and artifical pollination; crossing and hybridizing practised by students in the greenhouses and orchards.

Propagation of Varieties. By cuttings, layers, grafting and budding. Illustrated by specimens and practised by students in the greenhouses.

Setting Out Orchards and Fruit Plantations. Suitable soils and situations; distances for planting; marking out the ground; obtaining nursery stock; transplanting; watering; mulching.

General Management of Orchards and Fruit Plantations. Cultivation; manuring; spraying; thinning fruit: implements suitable for the different operations.

Different Kinds of Fruit. Apples, pears, quinces, plums, apricots, cherries, grapes, raspberries, blackberries, currants, gooseberries, strawberries, etc., treated of in detail according to the following syllabus: (1) History and botanical matter; (2) extent of cultivation; (3) methods of propagation; (4) soils suitable; (5) culture required; (6) methods of pruning and training; (7) time and manner of harvesting; (8) packing and marketing; (9) method of keeping and storing; (10) varieties grown.

VETERINARY SCIENCE.

Pathology. Osseous System. Nature, causes, symptoms and treatment of diseases of bone, as splint, spavin, ringbone, etc.

Muscular System. Nature, causes and treatment of flesh wounds, etc.

Syndesmology. Nature, causes, symptoms and treatment of curb, bog spavin and other diseases of the joints.

Plantar System. Nature, causes, symptoms and treatment of corns, sand-crack, founder and other diseases of the feet.

Odontology. Diseases of the teeth, and treatment of the same.

ENGLISH.

English Classics. Critical study of Shakespeare's "Julius Cæsar."

PHYSICS.

Dynamics. Force (different kind of); motion; laws of falling bodies; work; the simple machines.

Statics. Composition and resolution of forces; parallelogram of forces; conservation of energy.

Winter Term.—22nd January to 16th April.

AGRICULTURE.

Sheep. Origin and history of the leading breeds of sheep in Britain and America; coarse, medium, and fine-wooled sheep—their leading characteristics and principal points; practical handling and judging of sheep.

Swine. Origin and history of the leading breeds of swine in Britain and America: large and small breeds of swine—their leading characteristics and principal points; practical handling and judging of swine.

Natural Science.

Agricultural Chemistry.—Continuation of the subject from preceding term, as follows: Composition of plants in relation to the soils upon which they grow; rotation of crops; the classification of fodders according to their chemical composition and a general treatment of the science of cattle feeding; relation of feeding to manure; chemistry of the dairy.

Economic Entomology.—Anatomy, classification, and metamorphosis of insects; principal insects injurious to vegetation; their habits, and the best methods of checking and preventing their ravages; insecticides, and the best methods of applying them; beneficial insects referred to. Course illustrated by a good collection of beneficial and injurious and of insectivorous birds.

Meteorology. Relation of meteorology to agriculture; composition and movements of the atmosphere; description of the barometer; different kinds of thermometers; pluviameter and anemometer, and how to read them; temperature, its influence on agriculture; the elements which are to be considered in the discussion of climate; the principles considered in forecasting the weather.

Lectures illustrated by instruments referred to.

Horticulture.

1. Vegetable Gardening.

Gardening as an Occupation. Extent and importance of the industry; market gardening near large towns and cities.

The Farmer's Garden. Location, size, and soil suitable.

Fertilizers for the Garden. Barnyard manure; composts; artificial fertilizers; time and manner of applying them.

General Management of Garden. Preparation for and cultivation of crops; rotation of crops; plan of garden.

Garden Seeds. Method of obtaining; vitality; time and manner of sowing; conditions favorable to germination.

Raising Plants. Construction and management of hotbeds and cold-frames; transplanting.

Forcing Garden Crops. Illustrated by growth in the greenhouses of radishes, lettuce, onions, potatoes, tomatoes, cauliflowers, cucumbers, melons, rhubarb, mushrooms, etc.

Garden Crops. Beets, carrots, parsnips, salsify, radishes, turnips, potatoes, onions, asparagus, spinach, lettuce, cabbage, celery, rhubarb, cauliflower, peas, beans, corn, melons, squashes, cucumbers, tomatoes, herbs, etc., treated of in detail according to the following syllabus: (1) History and botanical matter; (2) Importance and extent of cultivation; (3) Soils and fertilizers suitable; (4) Propagation; (5) Culture and general management; (6) Harvesting; (7) Packing and marketing; (8) Storing; (9) Varieties grown.

2. Landscape Gardening.

Location of buildings; making and care of lawns; kinds, arrangement, and care of trees, shrubs, vines, hedges, and flower-beds; course and construction of walks and drives; general surroundings.

3. Arboriculture.

Importance of forests; their effect on climate; different kinds of trees—their occurrence, habits, and uses; where trees should be planted; raising trees from seed; planting operations; transplanting large trees; care and management of trees, with a view to ornament, shelter and economy.

4. Floriculture.

Soil for house plants; methods of potting; propogation of plants; effect of atmosphere, temperature and light on plants; watering; trimming and training; treatment of frozen plants; resting plants; kinds of plants suitable for window or conservatory, hanging baskets, rockeries, flower beds, etc.; arrangement of plants for effect.

VETERINARY SCIENCE.

Digestive System. Nature, causes, symptoms and treatment of spasmodic and flatulent colic, inflammation of the bowels, acute indigestion, tympanitis in cattle, impaction of the rumen, and many other common diseases.

Circulating System. Description of the diseases of the heart and blood.

Respiratory System. Nature, causes, symptoms, and treatment of catarrh, nasal-gleet, roaring, bronchitis, pleurisy, and inflammation of the lungs, etc.

Urinary System. Nature, causes, symptoms, and treatment of inflammation of the kidneys, etc.

Nervous System. Nature, causes, symptoms, and treatment of lock-jaw, string-halt, etc.

Sensitive System. Nature, causes, symptoms, and treatment of the diseases of the eye and ear.

Generative System. Nature, causes, symptoms, and treatment of abortion, milk-fever, etc.

Tegumental System. Nature, causes, symptoms, and treatment of scratches, sallenders, mallenders, parasites, and other diseases of the skin.

ENGLISH LITERATURE AND POLITICAL ECONOMY.

English Classics. The critical study of Shakespeare's "Richard II."

Political Economy. Utility; production of wealth—land, labor, capital; division of labor; distribution of wealth; wages; trades unions; co-operation; money; credit; credit cycles; functions of government; taxation, etc.

PHYSICS.

Hydrostatics. Transmission of pressure; the hydraulic press; specific gravity; density; pumps, siphons, etc.

Spring Term.—17th April to 30th June.

AGRICULTURE.

Breeding. Outline of the general principles of breeding.

Feeding. Feeding standards; feeding for growth, meat, milk, quality of milk, etc.

Care and management of cattle, sheep, and swine; care at different periods of growth, at different seasons, and under varying conditions.

NATURAL SCIENCE.

Determination of soils and fertilizers by physical properties.

Analytical Chemistry. Chemical manipulation, preparation of common gases and reagents; operations and analysis—solution, filtration, precipitation, evaporation, distillation, sublimation, ignition, and the use of the blow-pipe; testing of substances by reagents; impurities in water; adulteration in foods and artificial manures; injurious substances in soils.

Systematic and Economic Botany. Classification of plants and characters of the most important orders.

This course is illustrated by a large collection of plants in the college herbarium, and also by analysis of several plants collected in the fields and woods of the farm.

Greenhouse Plants. Special study of all plants grown in our greenhouses, and the shrubs, etc., on the lawn.

Veterinary Science.

Materia Medica. The preparation, actions, uses, and doses of medicines—continued from the spring term of the first year. Lectures on special subjects, such as pleuro-pneumonia, the rinderpest, tuberculosis, etc.

Veterinary Obstetrics. Description of fœtal coverings. Pneumonia in connection with puberty, œsirom gestation, sterility, abortion, normal and abnormal parturition. Diseases incidental to pregnant and parturient animals.

English.

English Classics. The critical study of Tennyson's "Locksley Hall," and Scott's "Talisman."

Physics.

Capillarity, latent and specific heat, as affecting draining and soil cultivation.

Road-making.

Determination of proper slopes; shape of road-bed; drainage of roads; various road coverings, etc.

OUTLINE OF THIRD YEAR WORK.

Agriculture.

(1) Principles and practice of general agriculture; (2) "Agriculture in some of its relations with chemistry" (Storer), Vols. I. and II.; (3) Composition, use, and practical application of the more common artificial fertilizers (Canadian and United States Experiment Station bulletins to date); (4) History, characteristics, and distinguishing points of all the pedigreed breeds of cattle, sheep, and swine now bred in America; (5) The principles which govern successful stock-breeding (Miles); (6) Construction and arrangement of farm buildings, with a view to cheapness, economy of space and convenience.

Dairying.

(1) "Analysis of Foods" (Blyth), Part IV., pp. 201-238; (2) "Dairyman's Manual" (Stewart); (3) "Milch Cows and Dairy Farming" (Flint); (4) "Scientific Dairy Practice" (Lynch); (5) "The Dairy" (Long and Morton); (6) "The Practical Butter Book" (Willard); (7) Reports of Dairy Associations of Ontario for 1891 and 1892, and subsequent reports to date; (8) Eighteenth Annual Report of the Ontario Agricultural College, Part VIII, and Report for 1893, Part IX; (9) Dairy bulletins and reports from Canadian and United States Experiment Stations, to date; (10) "Cheddar Cheese" (Decker); (11) Course of Lectures on dairying.

Chemistry.

The work in this department comes under four heads, each of which forms the basis of a separate examination.

(1) *General Chemistry, Organic and Inorganic.* "Advanced Course" and "Chemistry of the Carbon Compounds" (Remsen), with a course of lectures. Most stress laid on those elements and compounds which have a bearing on agriculture; laws and theories of chemistry discussed.

(2) *Agricultural Chemistry.* "Chemistry of the Farm" (Warington), and "Agriculture in some of its Relations with Chemistry" (Storer), with lectures, Vol. I., Chapters 1, 2, 3, 4, 7, 8, 10, 11 and 12; Vol. II., Chapters 5, 6, 7, 8, 9, 10, 15, 17, 18 and 19.

(3) *Animal Chemistry and Cattle Feeding.* "Manual of Cattle Feeding" (Armsby), with lectures.

(4) *Analytical Chemistry.* Qualitative and Quantitative Analysis, analysis of soils, fertilizers, agricultural products, etc.

Geology.

A general review of the subject, referring to ages, systems, and formations in Canada; special attention to the geology of Ontario, New Brunswick, Nova Scotia, Manitoba, and the Northwest, with reference to their most valuable economic products; the disintegration and decomposition of rocks in the formation of soil.

Natural History. (Three Examinations.)

Systematic and Economic Botany. Classification of plants and characters of the most important orders; special reference to the injurious fungi and weeds.

Structural and Physiological Botany. Cells and tissues in plants; organs of vegetation and reproduction; plants in relation to soil; processes of assimilation, absorption and metabolism.

Economic Entomology. Classification of insects; the consideration of seventy-five species injurious to plants and domestic animals, and the best means of killing them; beneficial insects aud insectivorous birds.

Microscopy. Manipulation of the microscope; methods of mounting specimens; drawing objects under the microscope; microscopic study of plant structures.

Books of Reference in Botany, etc. Injurious Insects (Saunders); Structural Botany (Gray); Physiological Botany (Vines); Systematic Botany (Gray's Manual and Spotton, Part II.); Injurious Fungi (Smith); Practical Botany (Hillhouse); Vegetable Histology (Strasburger).

English.

(1) Grammar (High School Grammar); (2) Composition and Rhetoric (Bain); (3) Outline of English Literature (Lectures with Spalding and Craik); (4) Themes; (5) Critical reading of the following selections:

Shakespeare—"Macbeth."

Bacon—Essays: Of Studies, Great Place, Boldness, Goodness and Goodness of Nature, Youth and Age, Discourse, Friendship.

Milton—"Lycidas" and "Paradise Lost," Book 1.

Pope—Essay on Criticism.

Addison—Spectator, Nos. 23, 26, 47, 93, 115, 162, 225, 381, 387, 483, 583, 598.

Wordsworth—The Solitary Reaper; Intimations of Immortality; Resolution and Independence.

Macaulag—Essay on Lord Bacon.

DeQuincey—William Wordsworth.

Tennyson—"Locksley Hall"; "In Memoriam," I-xxvii.

Note—In order to pass in this department, it is necessary, above everything else, that the candidate know how to spell correctly and be able to write good English.

Drawing.

Freehand and mechanical drawing, especially the drawing and construction of farm-houses, barns, stables, etc.—ground plans, elevations, sections, and construction.

APPENDIX III.

EXAMINATION PAPERS.

I. Papers Set at Easter Examinations, 1895.

FIRST YEAR.

Agriculture.

I. What is humus?
Discuss its influence and importance.

II. What is the difference between trench ploughing and subsoiling? Under what conditions might these operations respectively be advisable?

III. Mention the principal things to be observed in tile draining.

IV. Name an important variety of each of the following:
Fall wheat, spring wheat, white oats, black oats, two-rowed barley, six-rowed barley, peas, dent corn, flint corn and potatoes.

V. Point out the main points of difference between the requirements of the following crops:
(*a*) Alfalfa and Alsike clover.
(*b*) Turnips and mangels.
(*c*) Legumes and cereals.

VI. Give reasons for the following practices:
(*a*) Sowing fall wheat on pea stubble.
(*b*) Sowing grass seeds with barley after a root crop.

VII. Explain:
(*a*) Why a public highway may be extremely dry, and the soil of a cultivated field beside it may, at the same time, be quite moist.
(*b*) Why plants on a drained field may suffer less from drought than they would had the field not been drained.

VIII. Mention four things which you think to be of importance in selecting a dairy cow, and state fully what you would require with regard to the things mentioned.

Chemistry.

I. In test-tube (*a*) oxide of mercury, and in test-tube (*b*) iron, are heated. What effect has the heat on each? If any difference, state and account for it.

II. An exact weight of lead, exposed to the air, is heated for several hours in a porcelain dish. Does the lead increase or decrease in weight? What is the relation between the change in the weight of the lead and the composition of the atmosphere?

III. Into one jar of oxygen gas, a piece of charcoal at the ordinary temperature, and into another a piece of glowing charcoal, are put.
1. Note the phenomena occuring in each jar.
2. What properties of oxygen are illustrated by these experiments?

IV. How much mercury oxide would be necessary to furnish ten grams of oxygen? Hg = 200; O = 16.

V. Describe any experiment by which it may be shown that nitrogen forms about four-fifths by volume of the atmosphere.

VI. Complete the following equations:

1. $KOH + NH_4Cl =$
2. $Ca(OH)_2 + NH_4Cl =$
3. $NaCl + H_2SO_4 =$
4. $NaBr + MnO_2 - H_2SO_4 =$
5. $P_2O_5 + H_2O =$
6. $CO + CuO =$
7. $CO_2 + Ca\ (OH)_2 =$
8. $Cl +$ KOH warm and concentrated) =

VII. Two oxides of nitrogen in separate cylinders are tested. The one supports combustion; the other does not, but turns brown upon exposure to air. Name each oxide.

VIII. Sketch an apparatus that may be employed in preparing sulphuretted hydrogen (H_2S). What substances are required in preparing this gas?

IX. What phenomena did you observe when molybdic solution was added to a hot nitric acid solution of a piece of bone?

X. Into one of two test-tubes, each containing a water solution of KI, are put a few drops of chlorine-water, then the contents of each tube are treated with starch-paste. What change, if any, did the starch-paste produce in each case, and why this change?

Geology.

I. State what ingredients are added to the soil by the decomposition of the boulders of the field, and name the chief agents that affect it.

II. Name the rock systems absent in Ontario, and the places where such are represented. How do you account for their absence?

III. Give the economic products of the Laurentian rocks, and also those of the Silurian.

IV. Distinguish the fishes of Devonian rocks from those of the Eocene.

V. Draw diagrams representing the following: Valleys of denudation and dislocation, conformability, dip, and a section of a coal bed.

VI. Name the characteristic fossils of the coal period, and outline briefly how coal has been formed.

VII. Give the proofs for believing that the interior of the earth is in a heated condition.

VIII. Upon what rock systems are Whitby, Guelph, Brockville and St. Mary's located?

IX. Into what classes or groups are rocks divided? Define each.

X. Give notes on the life represented in Jurassic rocks.

Zoology.

I. Name the different systems considered in classifying animals, and illustrate.

II. Compare the breathing apparatus in the following: Salmon, butterfly, whale and frog.

III. Give examples of mimicry, hybernation and parasitism.

IV. Describe the changes undergone by an insect in its development. What term has been applied to such changes?

V. Give the characters of teleostean fishes and their distribution in time.

VI. Show in what respect worms become important factors in the formation of soil.

VII. Distinguish between the rodentia and the carnivora.

VIII. Give a list of Canadian wild ducks and examples of birds belonging to the orders scansores, cursores, raptores.

IX. Describe the life history of Tænia solium.

X. What is a coral reef, and where are they found? Mention the different kinds.

Veterinary Anatomy.

I. Describe the Linea alba.

II. Trace the food through the whole length of the alimentary canal, and state the changes, and the causes of the changes, it undergoes in its passage.

III. Describe the peritoneum.

IV. Name the urinary organs of the male, and describe a malpighian body.

V. Describe the stomach of the ox.

VI. State the difference between the liver and its duct of the horse and those of the ox.

VII. Describe the epididymis.

VIII. Describe the heart.

IX. Give a general description of the course of the blood from the time it leaves the left ventricle of the heart until it reaches the right auricle.

X. Describe the membrana nictitans.

Literature.

I. The glories of our blood and state are shadows, not substantial things; there is no armour against fate; Death lays his icy hands on Kings; sceptre and crown must tremble down and in the dust be equal made with the poor crooked scythe and spade.

(*a*) Write in verse form.

(*b*) State the kind of metre and rhyme.

(*c*) Point out and explain the figures of speech.

(*d*) Explain the terms, "blood," "state," "icy hand."

(*e*) Write the meaning of the selection in one brief sentence.

II. Quote from the Ode to Duty the stanza commencing:

I, loving freedom . . . . .

(*a*) Write briefly the meaning of the stanza.

(*b*) Explain clearly the meaning of each line separately.

(*c*) Give another title to the poem expressing more fully the central thought.

(*d*) What can you learn from this poem of Wordworth's character?

III. Which of the three poems do you prefer, The Bard, Ode to Duty, or Battle of the Baltic? Give reasons for your choice.

IV. Quote any one of the twenty-line stanzas from The Bard.

V. Give the name of the author and the name of the poem, to which the following lines, respectively belong:

(*a*) We carved not a line, and we raised not a stone.

(*b*) But the tender bloom of heart is gone, ere youth itself be past.

(*c*) My eyes are dim with childish tears.

(*d*) Where ignorance is bliss,
'Tis folly to be wise.

(*e*) He gave to misery all he had, a tear.

(*f*) The best laid schemes of mice and men,
Gang aft awry.

IV. Write, after Addison, an essay on "Westminster Abbey", or "Improving the Time."

Grammar and Composition.

I. What is case?

How many case forms have nouns and pronouns respectively?

Illustrate your answer.

II. Give the future predictive, and the future interrogative of the verb *strike*.

III. Improve the following sentences, giving reasons for changes made:

(1) My old friend, after having seated himself, and trimmed the boat with his coachman, who, being a very sober man, always serves for ballast on such occasions, we made the best of our way to Fox-hall.

(2) Alarmed by so unusual occurrence, it was resolved to postpone their departure.

(3) Rising from these table-lands, the traveller will see lofty ranges of granite mountains.

(4) Near the town is a deep ravine, containing a wonderful variety of trees, shrubs, and herbs, and which extends eastward nearly four miles.

IV. Explain the difference in the meaning of the terms, "simple sentence" "sentence" and "paragraph".

V. In the Old Colony days, in Plymouth, the land of the Pilgrims,
To and fro in a room of his simple and primitive dwelling,
Clad in doublet and hose, and boots of Cordovan leather,
Strode with a martial air Miles Standish, the Puritan Captain.
Buried in thought he seemed, with his hands behind him, and pausing
Ever and anon to behold his glittering weapons of warfare,
Hanging in shining array along the walls of the chamber,
Cutlass and corselet of steel, and his trusty sword of Damascus,
Curved at the point and inscribed with its mystical Arabic sentence,
While underneath, in a corner, were fowling piece, musket, and matchlock.
Short of stature he was, but strongly built and athletic,
Broad in the shoulders, deep-chested, with muscles and sinews of iron;
Brown as a nut was his face, but his russet beard was already
Flaked with patches of snow, as hedges sometimes in November.

In the above passage:

(1) State the kind of the first sentence.

(2) Make a list of the preposition phrases in the first sentence, stating their kind and telling the words which they modify.

(3) Paraphrase the whole passage.

VI. Write a composition of at least two paragraphs, on *one* of the following subjects:

(1) How to spend a holiday.

(2) The value, to the farmer, of a good education.

Arithmetic.

I. A room is 24 ft. by 20 ft.; in the centre part is a carpet which measures 21 ft. by 17 ft. Find the cost of painting the rest of the floor at 12c. per square yard.

II. Define Linear Foot, Square Foot, Cubic Foot, Broad Foot,. Express in inches the perimeter of a field 4 rods by 40 rods. Find the area in acres.

III. How many board feet in a pile of lumber consisting of:

30 boards each 15 ft. long, 10 in. wide, 1 in. thick.
25 planks " 12 ft. long, 8 in. wide, 2 in. thick.
20 scantlings " 16 ft. long, 3 in. wide, 3 in. thick.

IV. Explain clearly what is meant by Similar Triangles.

If the slope of a hill is 1 in 30, find the height of a hill which is half a mile long.

V. If a tax of $2.30 is paid on a salary of $1,200, $700 being exempt from taxation, find the rate.

VI. A town requires $19,600 to meet expenses for the year; it pays 2 per cent. for collection. What must be the rate, if the taxable property is assessed at $1,200,000?

VII. How many bushels of turnips are there in a wedge-shaped pit 27 ft. long, 5 ft. wide, 4 ft. high?

VIII. State the rules that should guide you in operations in concrete arithmetic. Give an example of each. Explain clearly how you would find the height of a box, having given the length, breadth, and volume. Use definite quantities in your explanation.

IX. Find the area of a regular twelve-sided figure, inscribed in a circle of 7 ft. radius.

Book-keeping.

I. Define, and write an example of each of the following:

Promissory Note, Receipt, Order, Check, Draft.

II. Explain clearly what is the purpose of each book used in keeping a set of accounts.

III. Journalize the following so as to give a fair statement of actual proceeds,

August 15.

(*a*) Have harvested and threshed from field No. 4, 160 bushels Oats, assumed to be worth 50c. a bushel.

September 15.

(*b*) Have Havested from field No. 5, 150 bushels potatoes, assumed to be worth 40c.

December 15.

(*c*) Sold 40 bushels oats for cash at 40c.

December 30.

(*d*) Sold 20 bushels potatoes for cash at 50c.

IV Write the following in Day Book form:

(*a*) Field No. 6. Dr.....	$ 7.00	
To Cash		$ 7.00
(*b*) Farm Produce. Dr.....	200.00	
To field No. 6		200.00
(*c*) Cash. Dr.....	288.00	
Farm Produce. Dr.....	24.00	
To field No. 3		312.00
(*d*) Loss and Gain. Dr.....	89.00	
To Plant		89.00

SECOND YEAR.

Agriculture.

I. Discuss the utility of Dorset Horn Sheep.

II. Explain how Shropshire sheep differ from Oxfords, and note the principal points in the history of each.

III. What points of resemblance and what points of difference are there between Tamworth and Improved Yorkshire hogs.

IV. Account for the popularity of Short Horn cattle.

V. Describe the type of bull which you think could be mated most successfully with the Roan Short Horn Cow, "Laundress," belonging to the College.

VI. To what would you attach importance in selecting:
(*a*) A Hereford bull;
(*b*) An Aberdeen-Angus cow?

VII. Briefly mention any facts that have given prominence to the following names:
Bakewell, Bates, Ellman, Watson, Cruickshank, Tompkins, Duthie, and Moberley.

VIII. Why do so many breeds of live stock continue to exist. Illustrate your answer by reference to the breeds of cattle.

IX. Discuss the present condition of the cattle, sheep, and hog market, accounting for its condition, and deducing any lessons that are to be learned from it.

Judging Cattle.

I. State which of the two cows (Devon and Sussex) you would prefer, as a dam from which to breed beef animals, and state the *principal* reasons for your preference.

II. Criticize the skin, udder, milk, veins, and milk-wells of the grade cow.

III. Criticize the Shorthorn heifer as a representative of the breed.

Horticulture.

I. Give briefly the methods of propagating the following: Grapes, gooseberries, raspberries, strawberries, asparagus and rhubarb.

II. Describe with drawings the renewal system of pruning and trellising grapes.

III. Discuss the subject of cultivation among orchard and garden crops.

IV. Write notes on the farmer's garden, under the following headings: Location, soil, size, shape, cultivation and rotation.

V. In what respect do garden seeds differ? How should these differences affect the time and manner of ordering and sowing such seeds?

VI. Outline the management of a potato crop from the time of planting till harvesting.

VII. Write brief notes on the structure and development of the edible parts of the following: Apple, raspberry, strawberry, carrot, potato, onion, cabbage and cauliflower.

Chemistry.

I. The proportions of the several constituents composing the whole bodies of animals are influenced by growth, fattening and maturity. How do these respectively influence the several constituents composing the animal body?

II. Animal bone, muscle and blood are distinct sources of incombustible constituents. What ash constituents predominate in each? and in about what proportions do they occur?

III. Calculate the loss of phosphoric acid, potash and nitrogen to the farm by the sale (1) of six hundred gallons of milk, (2) of only the cheese of six hundred gallons of milk, and (3) of only the butter of six hundred gallons of milk.

IV. Ptyalin, pepsin and trypsin are unorganized ferments.

(1) In which digestive agents do these respectively occur?

(2) By which digestive agent, or agents, and how, is each nutrient of the food digested?

V. An animal receives abundant food, excessively rich in albuminoids, and equilibrium between protein fed and protein consumption becomes established. What will be the effects, economic and otherwise, of the following changes:

(1) Adding more albuminoids to the ration?

(2) Reducing the absolute amount of albuminoids in the ration?

(3) Rapidly reducing the absolute amount of albuminoids while proportionately increasing the carbo-hydrates?

(4) Changing rapidly to a cheaper ration of an albuminoid ratio of 1 : 8.5.

VI. Give reasons for or against allowing animals free access to water and salt.

VII. It is required to produce upon a given acreage the largest quantity of red clover hay of the highest nutritive value. Mention every necessary precaution, with reasons, to be taken in producing this quantity and quality of hay.

Veterinary Pathology.

I. Give the causes, symptoms and treatment for speedy cut.

II. Name the different kinds of broken knees and give treatment for each kind

III. Name the diseases of the feet and give treatment for corns.

IV. Give symptoms and treatment for nasal gleet.

V. Give symptoms and treatment for choking in the ox.

VI. Give causes, symptoms and treatment for foul in the feet of cattle.

VII. Give treatment for fistulous withers.

VIII. What is umbilical hernia? Give treatment.

IX. Give treatment for lice on cattle.

X. State the difference between the symptoms of spasmodic colic and those of inflammation af the bowels, and give treatment for the latter.

Literature.

I.

Com'st thou because the *anointed* King is *hence?*
Why, foolish boy, *the King is left behind,*
And *in my loyal bosom lies his power.*
Were I but now *the lord of such hot youth*
As when brave Gaunt, thy father, and myself
Rescued the Black Prince, *that young Mars of men,*
From forth the ranks of many thousand French,
O, then, how quickly should this arm of mine,
Now *prisoner to the palsy*, chastise thee,
And *minister correction to thy fault!*

(*a*) Who is the speaker? To whom, and on what occasion is he speaking?

(*b*) State briefly (not more than ten or twelve lines) the condition of affairs in England at this time.

(*c*) How many persons are mentioned in line 5?

(*d*) Give in simple prose the meaning of the above passage, taking special care to make clear the meaning of the italicized words and phrases.

II. Give a brief account of any *one* of the following scenes, and show how it contributes to the author's purpose in the play :

(*a*) The scene in Wales between the Earl of Salisbury and the Welsh Captain.

(*b*) The scene in the Duke of York's garden, in which the Queen, her ladies and the gardeners appear.

(*c*) The scene in the Duke of York's palace, in which the Duke, the Duchess and Aumerle are represented.

III. In the following passages, give the speaker and the connection; and explain clearly the meaning of the italicized portions :

(*a*) And formally, according to our law,
Depose him in the justice of his cause.

(*b*) The *fly-slow* hours shall not *determinate*
The *dateless limit* of the *dear* exile.

(*c*) From my own windows torn my *household coat.*

(*d*) My father hath a *power;* inquire of him,
And learn *to make a body of a limb.*

(*e*) My *wretchedness unto a row of pins,*
They'll talk of *state;* for every one doth so
Against a change.

(*f*) And put on *sullen* black *incontinent.*

IV. Quote any five consecutive lines of Gaunt's panegyric on England.

V. To illustrate or explain what is each of the following similes used :

(*a*) As seven vials of his sacred blood.

(*b*) . . . . . Like two men
That vow a long and weary pilgrimage.

(*c*) As gentle and as jocund as to jest.

(*d*) . . . . . as sugar
Making the hard way sweet and delectable.

VI. In what different characters does Saladin appear in "The Talisman"? Describe briefly the meeting of the knight of the Leopard with him in each of the characters.

Political Economy.

I. What is the province of Political Economy? Discuss at length.

II. Is a general rise in prices a good or a bad thing for a community?

III. What are the qualities requisite in a substance to render it a good basis for a currency? Apply your conclusions to show whether monometalism or bimetalism would be more serviceable to Canada.

IV. State the leading rules which should be observed in levying taxes. Show where any of these rules are contravened in our system of Municipal, Provincial or Dominion taxation.

V. Discuss the question, whether the great excess of imports over exports is a desirable economic condition.

VI. Should trades unions insist that none of their members take less than a defined minimum wage in each district?

Physics.

NOTE.—Use diagrams as much as possible. Nos. 3, 6, 9, 10, 11, 12, and any three of the remaining six, will constitute a full paper.

I. Describe and explain the action of Bunsen's Filterer.

When running without any attachments, what is the appearance of the water in the lower part of the tube? Explain.

II. Explain the construction and use of the water-hammer.

III. Define specific gravity.

State the law by which you determine the specific gravity of heavy bodies by immersing in water.

Describe Nicholson's Hydrometer, and relate the experiment by which you determine the specific gravity of lead or mercury, giving quantities if possible.

IV. Describe an experiment that you have conducted which illustrates the property of a gas.

V. Explain the action of the ordinary lift pump.

VI. Define Pressure, Friction, Gravitation, Passive Force.

A glass cylinder three and one-half inches in diameter, sixteen inches high, is filled with water. Find the total pressure on the sides and bottom of the cylinder, reckoning air-pressure at fifteen pounds per square inch.

VII. Explain fully the action of the siphon. Upon what does the velocity of flow depend? Will the siphon work in a vacum?

VIII. Show how to find the total pressure at the mouth of an inverted funnel when filled with water.

IX. Define Capularity, Saturation.

Describe fully the action of water and murcury, respectively, when tubes of different bores are inserted into the liquids; and deduce, from the action of water in the tubes, the condition of soil favorable to capillary action.

X. Describe and explain fully the movements of water in the soil from the time when it enters dry soil to the point of saturation, and thence through a drying period. Under what conditions are drains necessary?

XI. Define Mass, Weight, Moment of a Force.

If the slope of a hill is one in fifteen, and the co-efficient of friction is one-twentieth, what is the least force that would be required to move up the hill a load of 3,000?

XII. Write a brief essay on the subject of "Wells," under the heads: kinds, sources, causes of failure.

Drawing.

I. (*a*) Construct a triangle, its sides being three-quarters, one, and one and one-half inches respectively.

(*b*) On each side construct a square.

II. Given a building 34′ x 58′ outside measurement, with walls 1′ thick:

Arrange the building for a stable to contain twenty cows, making two-two rows of double stalls running lengthwise of the building and facing a central feed passage. Also show feed-room and silo at one end and on the inside of the building, and all necessary doors and windows.

Scale, one-eighth inch to one foot.

Indicate all measurements.

II. Papers Set at Midsummer Examinations, 1895.

FIRST YEAR.

Agriculture.

I. Describe the type of hog which you think is the most profitable to raise.

II. What injurious effects have weeds?
How are weeds distributed?

III. Describe the habits of growth of the following weeds, and name the crops in which they flourish:

Wild flax, mustard, ox-eye daisy, ragweed, and burdock.

IV. How would you treat a field infested with:

(*a*) Couch grass.

(*b*) Canada thistles.

V. Explain the advantages to be derived from following a systematic rotation, and state the principal things to be observed in planning a rotation.

VI. Under the following heads, write notes on the cultivation of millet and corn:

(1) Place in rotation.

(2) Cultivation of soil.

(3) Time and method of sowing.

(4) Quantity of seed per acre.

(5) Proper time to harvest.

(6) Utility.

VII. How would you proceed to improve a clay soil that had been greatly over-cropped, and upon which clover generally winter-killed through being heaved by frost?

Dairying.

I. Give a minimum yearly standard for dairy cows. How would too low a standard of production affect profit and loss in the dairy?

II. Outline the best method of securing a profitable dairy herd for the average farmer.

III. What are the chief points in a good dairy stable? Give the best methods of watering, tying, and keeping cows clean and healthy during the winter.

IV. Outline the present methods of judging cows at exhibitions, and suggest some improvements.

V. Give what you consider would be a profitable ration for milking-cows during the winter. What points should be considered in deciding on a ration?

VI. What combination of grains will give best results in soiling cows? Name a suitable series of soiling crops for Ontario.

VII. Explain the secretion of milk in the udder.

VIII. To what extent would a successful milking machine affect dairying? Describe any that you have seen or heard about, and the results.

IX. Discuss the relative feeding value of skim-milk, butter-milk, and whey: (1) for feeding pigs, (2) for feeding calves.

X. Name the different kinds of cream separators in the new dairy building, and tell which are belt machines and which are turbines.

Poultry.

I. Name the varieties of fowl in the Asiatic class, and state whether they are sitters or non-sitters; also give the color of eggs and the standard weights.

II. State the main points of difference between the Langshans and the Cochins.

III. Give a list of the varieties in the American class, and state whether they are sitters or non-sitters; also give briefly the leading characteristics of this class.

IV. Describe the comb and the plumage of the Golden and the Silver-laced Wyandottes.

(*a*) Give the chief disqualification in the Wyandotte varieties.

V. What are meant by the "hackle," the "primaries," and the "secondaries," "barring," "pencilling," and the "shaft"?

VI. State what you regard as essential to the health and comfort of fowls.

VII. Describe what you consider a suitable roost for hens, giving size, height, and method of construction.

VIII. What should be done to keep hens and hen-house free from vermin?

(*a*) How would you proceed to get rid of lice in poultry buildings?

IX. What would you use for soft food? How would you mix and feed it?

X. Name the two best varieties of hens for the Ontario farmer. Compare them, and state as fully as you can the reasons for your choice.

Bee-Keeping.

I. How many kinds of bees form a colony?

(*a*) Give the sex of each.

(*b*) Give the average lifetime of each.

II. In the keeping of bees and the production of a honey crop,

(*a*) What advantage does the horticulturist in the vicinity derive?

(*b*) How does bee-keeping affect the fertility of the farm? Give reasons for answers in both cases.

III. Give the use of Comb Foundation, Section, and Brood.

IV. In the specimens of Comb Foundation before you, Nos. 1, 2, and 3, give order of preference for Comb Honey, and state reasons for your choice.

V. State briefly rules to observe when handling bees so as to guard against being stung.

VI. Explain the use of the self-hiver, giving its advantages and disadvantages, if any

VII. As regards the depositing of eggs, how can you tell the difference between the work of a normal queen and fertile workers?

VIII. Give briefly the method of preparing old comb for the wax extractor.

Botany.

I. State all the ways endogenous plants can be distinguished from exogenous.

II. Describe fully the pistil, and distinguish between a vegetable and a fruit. Give five examples of vegetables.

III. Name the different kinds of irregular flowers and the orders in which they are found.

VI. Explain the terms plumule, follicle, pepo, nucellus, parianth and micropyle.

V. Give a list of weeds found in the Cruciferæ, Labiatæ, and Compositæ.

VI. What are the characters of the Rosaceæ and Leguminosæ?

VII. Classify the orders you have studied into groups of economic value, for fruits, flowers, vegetables, and grain.

VIII. How are plants nourished before and after they appear above ground?

IX. Identify the plants before you.

Materia Medica.

I. Define and give an example of (*a*) a caustic, (*b*) a rubefacient, (*c*) an aphrodisiac, (*d*) a tonic, (*e*) a stimulant.

II. Mention the different ways in which medicines can gain access to the circulation in order to establish their actions.

III. Define the following terms: (*a*) infusions, (*b*) decoctions, (*c*) tinctures, (*d*) fomentations, (*e*) drenches.

IV. Give the properties, actions, uses, and doses of Areca nut.

V. Give the actions and uses of Antimony Tartrate (Tartar Emetic) and state why it should not be given in full doses for a long time.

VI. Give the actions and uses of eserine; state how it should be administered, and give the doses.

VII. Give the properties, actions, and uses of cantharides.

VIII. What is quinine? Give its actions.

IX. Give the actions, uses, and doses of Sweet Spirits of Nitre.

X. Give the actions, uses, and doses of the Hyposulphite of Soda.

English Literature.

I. State briefly the *matter*, and explain clearly the *method of treatment*, of "The Art of Book-making."

II. "Formerly there were some *restraints* on this *excessive multiplication.*"

Discuss the above in a paragraph, explaining clearly the italicised words.

III. "That *chivalrous courage* which *induces* us to *despise* the *suggestions of prudence* and to *rush in the face* of certain danger, is the *offspring of society*, and produced by *education.*"

(*a*) From which essay is the above taken?

(*b*) What particular topic is being discussed?

(*c*) Re-write the above, substituting equivalent expressions for those in italics.

IV. "On a fine autumnal afternoon, Ichabod, in pensive mood, sat enthroned on the lofty stool from which he usually watched all the concerns of his little literary realm. In his hand he swayed a ferule, that sceptre of despotic power; the birch of justice reposed on three nails, behind the throne, a constant terror to evil doers; while on the desk before him might be seen sundry contraband articles, and prohibited weapons, detected upon the persons of idle urchins."

(*a*) Shew, in detail, in what the *humor* of this passage consists.

(*b*) Re-write the passage, substituting for the humorous expressions their literal equivalents.

V. What is meant by the *style* and the *purpose* of an author? Give a general discussion of these (style and purpose) in the case of Irving.

VI.

One summer day I chanced to see
This old man doing all he could
To unearth the root of an old tree
A stump of rotten wood.

(*a*) Criticize the poetry of this selection.

(*b*) Relate briefly the story of the poem from which this selection is taken.

(*c*) Quote the last two lines of the poem and explain their meaning.

VII. (*a*)

The whispering waves were half asleep,
The clouds were gone to play,
And on the bosom of the deep,
The smile of Heaven lay;
It seemed as if the hour were one
Sent from beyond the skies
Which scattered from above the sun
A light of Paradise.

(*b*)

It is a beauteous evening, calm and free;
The holy time is quiet as a nun
Breathless with adoration; the broad sun
Is sinking down in its tranquility;
The gentleness of Heaven is on the sea.

Make a full critical comparison of these two selections.

Grammar.

I. What are auxiliary verbs? Name the principal English auxiliaries.

II. Give the past perfect indicative, and the present and past subjunctive of the verb *be*.

III. Discuss the uses of *shall* and *will*, and *may* and *can*, and apply what you have said in criticizing the following sentences:

(1) If I had saved my money years ago, I would not have been in this condition.

(2) When will you be able to pay me back?

(3) If you work well to-day, you will have a holiday to-morrow.

(4) Can I speak to him when he comes?

IV. Explain how a progressive verb phrase differs from a passive verb phrase, and give an example of each.

V. Explain the different methods of completing incomplete predicates, giving an example of each method.

VI. Punctuate the following sentences, and insert capitals where necessary, giving reasons:

(1) And nathan said unto david thou art the man.

(2) Prosperity makes friends adversity tries them.

(3) The storm being over he departed.

(4) Dear gentle patient noble nell was dead.

VII. Analyze fully the following sentences:

(1) Such as I have give I unto thee.

(2) He said that the storm had destroyed the trees which he had planted.

VIII. Correct, giving reasons, any errors in the following:

(1) It is me that will have to suffer.

(2) His diet was scanty, his prayers long and fervent.

(3) A fondness for show is, of all other follies, the most vain.

(4) The fact of me being a stranger to him, does not justify his conduct.

(5) I have never seen Major Cartwright, much less enjoy the honor of his acquaintance.

Composition.

I. Write an essay on any *one* of the following subjects :

(*a*) A sound mind in a healthy body.

(*b*) Advantages of education.

(*c*) Pleasures of travel.

(*d*) The blessing of friends.

(*e*) The beauties of nature.

(*f*) Ambition.

Marks will be given for, writing, use of capitals, spelling, punctuation, vocabulary, sentence structure, paragraph structure, plan of essay, value and originality of substance.

Arithmetic.

I. A mixture of oats and barley, forty-two bushels, weighs 1,806 pounds. How many bushels of each in the mixture
Give two methods of solution.

II. Determine $(1.05)^{25}$, correct to four decimal places.

III. What sum, deposited each year for twenty years, will amount, at the end of that time, to $2,000, money being worth five per cent? And hence if a premium of eighty dollars a year is paid for a policy of $2,000, twenty-year endowment, how much per year is paid simply for insurance?

IV. How many bushels of corn and peas must be mixed with seven bushels of barley, so that the mixture may average fifty-three pounds per bushel ?
Integral solution required.

V. Prove the following, using the number 478 as an example :
The remainder obtained on dividing any number by nine is the same as that obtained on dividing the sum of the digits composing that number by nine.
Multiply 98,764.35 by 7,060,805 and test your results by casting out nines.

VI. A rope ninety-eight feet long has its whole length wound round a building twenty-one feet square. How far will a person walk in unwinding the rope until it is straight, keeping it tight all the time?

VII. The sides of a right-angled triangle are fifteen, twenty, twenty-five feet, respectively ; a perpendicular is drawn from the right angle upon the hypotenuse ; find (1) the length of this perpendicular, and (2) the length of the segments into which the perpendicular divides the hypotenuse.

SECOND YEAR.

Agriculture.

I. Write brief notes on the characteristics and utility of Holstein-Friesian cattle.

II. Explain wherein the treatment of a heifer, intended for dairying purposes, differs from that of one intended for beef purposes.

III. Note briefly the principal points in the care of a young sow from the time she is weaned until she has had her first litter of pigs.

IV. Enumerate as briefly as possible the principal things to be observed in the care of a flock ofewes from the time they are bred until after the lambs have been weaned.

V. Which of the cross-bred hogs in the farm piggery do you prefer? State fully the reasons for your preference, and compare the hogs in question with the other cross-breds which are in the same building.

VI. (*a*) Comment on the value of a pedigree.

(*b*) Why use pedigreed sires?

VII. Explain the importance of heredity and variation in stock breeding.

VIII. Write notes on the growing and selection of seed grain.

Dairying.

I. Indicate how a handy table may be constructed for reckoning fat values at a cheese factory or creamery.

II. At the Guelph Station dairy in the month of September, 1894, 1,800 pounds of milk, averaging four per cent fat, produced 179¾ pounds cheese; the same quantity (1,800 pounds) of milk, averaging three per cent. fat, produced 152¾ pounds cheese. If this milk had been supplied by two patrons of a factory and the cheese netted ten cents per pound, what amounts of money would each receive if the milk was "pooled"?

(1) According to weight of milk.

(2) " " per cent. of fat in milk.

(3) " " per cent. of fat + two to fat readings.

(4) " " weight of cheese.

III. Indicate the chief features of the McLennan Bill. State its origin and probable effects if it becomes law.

IV. What is meant by the term "half-pound, up-beam weight"? What gave rise to this rule? What objection have factory men to complying

V. When is a curd ready to cut? Describe the process.

VI. What is the most important quality in a cheddar cheese? How may it be injured?

VII. Give the temperature for "setting," "cooking," "salting," "putting to press," and for the curing room in cheddar cheese-making.

VIII. State the advantages and disadvantages of the separator creamery.

IX. Give a list of cream separators on the market, with prices and names of the manufacturers. Which is the best separator? What are the causes for the bowl of the separator vibrating?

Poultry.

I. Name the varieties of fowl in the Mediterranean class, giving briefly their leading characteristics; and state whether they are sitters or non-sitters.

II. Describe the comb and color of plumage of Light Brahmas.

III. What is meant by the following technical terms:

"Fluff," "cushion," "duck-foot," "wattles," "crest," "breed," "carriage," "crop," "hock"?

IV. Describe a "rose," "single" and "pea" comb.

V. Give some of the disqualifications for the following breeds: Rocks, Langshans, Silver Laced Wyandottes, and White Javas.

VI. Give the standard weight of the Wyandottes.

VII. Before building a poultry house, what is the first thing to be considered; also what size would you build to accommodate fifty hens?

VIII. Name three varieties of fowl that you would select for winter layers; also three varieties for summer layers.

IX. State what you would use for soft food. How would you mix, and when would you feed it?

X. Give periods of incubation of hens, ducks and geese.

XI. On what day during incubation should you test eggs? How will a fertile egg appear on that day; also an unfertile one?

Bee-keeping.

I. Give the length of time it takes, under normal conditions, for the drone, workers and queen to develop from the depositing of the egg to the winged insect, mentioning the time of each in the egg stage.

II. State the various conditions under which the bees will build queen cells.

III. In the specimens before you, Nos. 1, 2 and 3,

(*a*) Which contain worker comb?

(*b*) Which contain drone comb?

IV. State briefly how excessive swarming can be prevented.

V. In the production of first-class extracted honey,

(*a*) What condition should the honey be in before extracted?

(*b*) How can you tell when this condition exists?

VI. In the production of comb honey, state briefly the leading points to be observed in producing a good article with the least labor.

VII. How can you distinguish "chilled brood" from "foul brood"?

Practical Chemistry.

I. Give one characteristic test for each of the following: Iron, aluminium, phosphoric acid, nitric acid and ammonia.

II. Name the group reagents, the bases precipitated by each reagent, and the conditions under which each group reagent precipitates its respective group of bases.

III. A certain salt, soluble in water, gives a white precipitate with a solution of lead nitrate, which precipitate dissolves in an excess of sodium hydroxide; the same salt gives no precipitate with the group reagents; but by treating an alkaline solution with a few drops of sodium phosphate solution, a white granular precipitate occurs. Name the salt.

IV. Does sample A contain phosphoric acid?

(*a*) Would you expect ammonia to escape from manure marked B?

(*b*) Is any ammonia escaping?

VI. Are nitrates washing from soil marked C?

Agricultural Chemistry.

I. (*a*) Name the physical conditions necessary to seed germination.

(*b*) Indicate, concisely, the slope of land, the class of soil, and the preparation of seed bed (in clay loam) most favorable for the germination of spring wheat.

II. "Carbonate of lime is beneficial to the soil in many ways." Discuss this. Would field No. 14, or any part of it, have been benefitted by liming before sowing with wheat and seeding down this spring? Support your answer with reasons.

III. (*a*) Give, approximately, the average percentage in farmyard manure of the following: Nitrogen, potash and phosphoric acid.

(*b*) In what proportion does each occur in the liquid excrement?

(*c*) Briefly state how to care for and apply farmyard manure to turnip land so as to obtain from its use the maximum amount of good.

IV. (*a*) Give the chemistry of the preparation of superphosphate from mineral of phosphate.

(*b*) Is it a fertilizer that can be advantageously used upon the farm, and, if so, upon what crops?

V. Name the leading characteristics of farm crops, determining their order in a rotation.

VI. (*a*) Briefly outline the fertilizer experiments with oats being conducted in the experimental department.

(*b*) Note the observations you have made this season regarding the effect of the fertilizers in this experiment.

Botany.

I. Describe fully the process of fertilization, and state how nature prevents self-fertilization.

II. Give the characters of the orders *Polygonaceæ* and *Scrophulariaceæ*, and give examples of weeds in each.

III. Draw diagrams illustrating open and closed fibro-vascular bundles, and mention how they are arranged in roots and stems.

IV. Name orders containing poisonous plants, and give examples in each order.

V. What causes the circulation of fluids in plants?

VI. Distinguish a grass from a sedge, and give the characters of the *Gramineæ*.

VII. To what orders do the following plants belong: Bind-weed, bloodroot, ginseng, tobacco, sorrel, pigweed, redroot and false flax?

VIII. Explain what is meant by the plan and formula of a flower, and give such of a Fuchsia and Trillium.

Horticulture.

I. How and when would you prune the following: Apple, pear, currant raspberry?

II. (1) Name the kinds of fruit growing here, and mention the prospect for this year's crop in each.

(2) How may the injury from frosts be first detected in the blossoms and newly formed fruits?

III. (1) Describe what you consider a complete outfit for spraying.

(2) How would you prepare a "stock solution" of the Bordeaux mixture?

IV. Give a list of the implements of most practical use in a vegetable garden.

V. (1) Write notes on the potting of house plants.

(1) Give a list of the plants you would select in making up a collection of two dozen.

VI. (1) Mention the authors and books you would recommend on the following subjects: (*a*) Fruit growing generally, (*b*) small fruits, (*c*) strawberry culture, (*d*) vegetable gardening, (*e*) potato culture, (*f*) floriculture.

(2) Name two of the leading horticultural periodicals.

VII. Identify the specimens before you, giving as far as possible the botanical and common names.

Veterinary Obstetrics.

I. Name, and define the four great functions of the generative system.

II. Name and describe the arrangement of the fœtal membranes.

III. What is abortion. Give the preventive treatment where abortion is indicated or suspected.

IV. In case of difficult parturition in which the whole four feet of the fœtus are presented, how would you proceed to deliver?

V. Give the symptons and treatment for parturient laminitis.

English Literature.

I. Mated with a squalid savage—what to me were *sun or clime?*
I the *heir of all the ages*, in the *foremost files of time*—
I that rather held it better man should perish one by one,
Than that earth *should stand at gaze* like *Joshua's moon in Ajalon?*
Not in vain the *distance beacons*, Forward, forward let us range.
Let the great world spin forever down the ringing groves of change.
Thro' the *shadow of the globe* we sweep into the *younger day:*
Better *fifty years of Europe* than a *cycle of Cathay.*

(*a*) Give in simple prose the subject of this extract, taking special care to make clear the meaning of the italicised passages.

(*b*) State fully the connection in which the extract occurs.

II. Give briefly the force of the following:—*Squalid, files, at gaze, beacons, range, spin, ringing, sweep.*

III. Ploughmen, shepherds, have I found, and more than once, and still could find,
Sons of God, and kings of men, in utter holiness of mind.

Truthful, trusting, looking upward to the practised hustings-liar,
So the Higher wields the Lower, while Lower is the Higher.

Here and there a cotter's babe is royal-born by right divine;
Here and there my lord is lower than his oxen or his swine.

Give the substance of this in your own words, and state its connection in the poem.

IV. Explain the meaning of the following passages, and state the connection in which each occurs:

(*a*) Puppet to a father's threat, and servile to a shrewish tongue.

(*b*) Summer isles of Eden lying in dark purple spheres of sea.

(*c*) Celtic Demos rose a Demon, shrieked and slaked the light in blood.

(*d*) Let the trampled serpent show you that you have not lived in vain.

(*e*) Sweet St. Francis of Assisi would that he were here again.

V. What are the following similes and metaphors used to illustrate or explain:

(*a*) . . . . . like a swarm of fireflies tangled in a silver braid.

(*b*) . . . . . as a lion creeping nigher
Glares at one that nods and winks behind a slowly dying fire.

(*c*) Baby fingers, waxen touches, press me from the mother's breast.

(*d*) Fires that shook me once, but now to silent ashes fallen away.

(*e*) Strowing balm, or shedding poisons in the fountains of the will.

VI. (*a*) State, with reasons for your answer, to what class of poems "Locksley Hall" belongs.

(*b*) What is meant by a *Dramatic Monologue*? Discuss briefly the appropriateness ness of the term as applied to "Locksley Hall."

VII. Explain clearly the different points of view in the two poems, and show the appropriateness of each both to the speaker and to the time.

Grammar.

I. Give the principal parts of *cut, sat, lain, hang, set, bear, swim,* and *went.*

II. Write the predictive, the permissive, and the interrogative future of *go.*

III. State concisely the auxiliary uses of *have* and *be*.

IV. Give the participles and the infinitive forms of *strike*, and state the uses of each.

V. Divide the following passage into simple sentences, stating the kind and connection of each, and parse the words italicised: "A pronoun, which almost never takes an attributive adjective before it, has an appositive adjective or noun *added* to it *just* as frequently as a noun has."

VI. Punctuate the following sentences and give the rule for each point used:

(*a*) Dashes marks of exclamation interrogation and quotation lend liveliness to composition they may be used to excess.

(*b*) Judged by his appearance he is fully forty years old.

(*c*) The subject is treated of under three heads as follows first the history of the tariff second the present condition of the tariff system third the features of the present system that are capable of improvement.

(*d*) *Can* indicates possibility as I can read.

VII. Correct or improve the following sentences where necessary, giving the reason for every change which you make:

(1) By this time the whole superstructure of the old family mansion was wrapped in the devouring element.

(2) I was surprised at him blushing.

(3) He is an old friend of us.

(4) Hoping to hear from you soon, believe me very truly yours.

(5) Thus much is certain.

(6) Consider everyone's circumstances, healths, and abilities.

(7) Try and do it as soon as possible.

(8) I will go and lay down.

(9) Him absent, we are unable to proceed.

(10) It's us that will have to pay the penalty.

VIII. Distinguish—

1 { An able and intelligent friend.
  { An able and an intelligent friend.

2 { He was happier than any person in the house.
  { He was happier than any other person in the house.

3 { Few men have been more honored.
  { A few men have been more honored.

Physics.

I. Describe the construction and explain the use of the theodolite.

II. Define Latent Heat of Evaporation, and describe an experiment by which you determine it; the apparatus being such as would give an accurate result.

Explain how the study of Latent Heat emphasizes the importance of draining

III. Describe the action of water at 4° Centigrade and discuss fully the economic importance of the phenomenon.

IV. Define Specific Heat.

A cavity is made in a block of ice; into this is introduced a lump of lead, weighing 500 grams, which has been heated to 100° in steam; the cavity is then capped with ice and the lead allowed to remain until cooled to zero. The cavity is then wiped dry with a sponge. The weight of the water is found to be 20 grams.

(1) State how this weight is found.

(2) State the object of the experiment.

(3) Determine the result of the experiment.

V. Describe the process of constructing a delicate Centigrade thermometer. Reduce 40° C. to F.

VI. State the thermal phenomenon in connection with each of the following, and give an example of each: (*a*) A gas is allowed to expand without the addition of heat. (*b*) A gas is suddenly compressed. (*c*) A solid is liquified without applying heat. (*d*) A liquid is evaporated without applying heat.

VII. Describe and explain the experiment known as "regelation."

VIII. Explain, in a general way, with reference to principles, the arc light and the incandescent light.

Road Making.

I. Explain the different systems of drainage of roadbed, location, capacity, depth, grade or fall to outlet, and best material to use for underdrains.

II. How should a roadbed be prepared (*a*) for earth roads, (*b*) for gravel or stone?

III. In constructing a gravel or stone road, give width and depth of material necessary, and explain process of applying the material.

VI. Explain best methods of maintaining (*a*) earth roads (*b*) gravel and stone roads.

Practical Mechanics.

I. Explain the essential points of a well-trimmed ripping saw.

II. Give the points of difference between a cross-cutting and ripping saw; explain the manner of filing the same and state the reasons for the difference.

III. How should panel saws for general work be filed?

IV. Give the number and names of the bench planes.

V. What plane is used first on rough surfaces? State the condition of the edge.

VI. Give the grinding angle of the basil of all planes.

VII. What is the use of the double iron or cover in planes, and how should it be set for smooth planing?

VIII. Name the tables or rules on the framing square.

IX. What numbers on blade and tongue of the square should we apply to find the down and level cuts for a common rafter?

X. Lay a square on the paper, the figure six on the blade at the edge, and figure seven on the tongue; and the blade will then be at an angle of fifty degrees. With this line as the given angle, construct the diagram that will give the three angles required in making a hopper.

Steam Engine.

I. How would you find the water level when your boiler is foaming?

II. Where would you put a steam gauge?

III. Why is a pet-cock put under the steam gauge?

IV. What is a steam gauge for?

V. If the steam gauge were out of order, what would you be governed by?

VI. Why is it necessary to have governors on an engine? Explain their working fully.

VII. What is the main throttle used for?

APPENDIX IV.

CLASS LISTS—EASTER EXAMINATIONS, 1895—FIRST YEAR.

Agriculture.

CLASS I.

1 Devitt, I. I.
1 Gadd, T. T.
3 Higginson, O. G.
3 Kewley, H. D.
5 Bell, T. C.

CLASS II.

1 Christy, E. V.
1 Ratcliffe, A. G.
3 Hodgetts, P. C.
3 Reinke, B. F.
5 Roblin, D.
6 Kennedy, A.
6 Wilson, A. F.
8 Bard, A. L.
8 Gamble, Wm.
8 McKenzie, M. A.
11 Oastler, J. R.
12 Morgan, G. W.
13 Yuill, J. J.
14 Nasmith, Jno.
15 Allison, D. H.
15 Benning, Jas.
15 Cunningham, J.

CLASS III.

1 Cousins, R. J.
1 Guy, J. T.
3 Harkness, R. E. L.
3 Leavitt, A. S.
3 Ross, M.
3 Shields, W. M.
3 Sissons, F. J. S.
8 Campbell, A.
8 Charlton, E. S.
8 Ross, N.
11 Findlay, J.
11 Stoddart, R. L.
13 Macdonald, A. W.
14 Hutton, H.
14 Irving, J. C.
16 Fierheller, E.
17 Evans, A. R.
17 Leggatt, Jas.
17 Leishman, J. E. B.
17 Robertson, G.
21 Brickwell, J. R.
21 Parker, F. A.
23 Harris, M. E.
23 McLaughlin, P.
25 Black, G. W.
26 Robertson, T. H.
27 Moffatt, T.
28 McDonald, J. D.
29 Bourassa, H.
30 Gilbert, S.
31 Gibson, T. E. F.

Arms, W. L.
Mather, J. W.
Waddy, P. H.
Strong, A.
Burk, H. W.
Gooch, G. E.

Chemistry.

CLASS I.

1 Higginson.
2 Gamble.

CLASS II.

1 Kewley.
2 Shields.
3 Hodgetts.
4 Leavitt.
5 Stoddart.
6 Devitt.
7 Parker.
8 McKenzie.
9 Cunningham.
9 Leggatt.
9 Yuill.

CLASS III.

1 Bard.
1 Roblin.
1 Ross, N.
4 Reinke.
5 Evans.
5 Ratcliffe.
7 Kennedy.
7 Nasmith.
7 Oastler.
10 Christy.
11 Gadd.
12 Cousins.
12 Guy.
12 Ross, M.
15 Bell.
15 Robertson, T. H.
17 Harris.
18 Brickwell.
18 Charlton.
20 Fierheller.
20 Morgan.
22 Hulton.
23 Sissons.
24 Wilson.
25 Benning.
26 Findlay.

Campbell.
Allison.
Harkness.
Robertson, G.
Macdonald, A.
Black.
Irving.
Mather.
McDonald, J. D.
McLaughlin.
Leishman.
Arms.
Bourassa.
Burk.
Gibson.
Gilbert.
Moffatt.
Strong.
Waddy.

Geology.

CLASS I.

1 Hodgetts.
2 Higginson.

CLASS II.

1 Kewley.
2 Gamble.
3 Shields.
4 Nasmith.
5 Guy.
6 Bard.
6 Charlton.
6 Oastler.
6 Reinke.
10 Christy.
10 Wilson.
12 Parker.
13 Devitt.
13 Ratcliffe.
15 Stoddart.
16 Leggatt.
16 McKenzie.

CLASS III.

1 Benning.
2 Gadd.
2 Roblin.
4 Cunningham.
4 Ross, M.
6 Bell.
7 Evans.
8 Leavitt.
8 Morgan.
8 Ross, N.
11 Yuill.
12 Sissons.
13 Findlay.
14 Kennedy.
15 Brickwell.
16 Irving.
16 Robertson, T. H.
18 Black.
18 Macdonald, A.
18 McLaughlin.
21 Cousins.
21 Fierheller.
21 Robertson, G.
24 Allison.
24 Harkness.
26 Campbell.
26 Hutton.
26 Mather.
29 Leishman.

Bourassa.
Harris.
Arms.
McDonald, J. D.
Gibson.
Burk.
Waddy.
Strong.
Gilbert.
Gooch.
Moffat.

Zoology.

CLASS I.

1 Hodgetts.

CLASS II.

1 Devitt.
2 Oastler.
3 Higginson.
4 Nasmith.
5 Parker.
5 Ratcliffe.
7 Gamble.
7 Shields.
7 Kewley.
10 Guy.
10 Ross, N.
12 Charlton.
13 Ross, M.

CLASS III.

1 Reinke.
1 Yuill.
3 Bard.
3 Roblin.
5 Gadd.
6 Robertson, T. H.
6 Benning.
8 Christy.
8 Leggatt.
8 Morgan.
11 Bell.
11 Wilson, A. F.
13 Cunningham.
13 McKenzie.
15 Leavitt.
16 Brickwell.
16 Robertson, G.
18 Evans.
18 Findlay.
18 Kennedy.
18 Stoddart.
22 Cousins.
23 Fierheller.
24 Allison.
24 Campbell.
24 Harkness.
24 Leishman.
27 Harris.
28 Sissons.
29 Bourassa.
29 Hutton.
29 McDonald, J. D.
29 Macdonald, A.
33 McLaughlin.
34 Mather.

Black.
Irving.
Gibson.
Waddy.
Arms.
Moffat.
Gilbert.
Burk.
Pugh.
Strong.

Veterinary Anatomy.

CLASS I.

1 Reinke.

CLASS II.

1 Gamble.
2 Guy.
3 Higginson.
4 Christy.
5 Devitt.
5 Ross, M.
7 Wilson.

CLASS III.

1 Hodgetts.
2 Oastler.
3 Kewley.
4 Shields.
5 Gadd.
6 Bard.
7 Nasmith.
7 Roblin.
9 Cousins.
9 Kennedy.
9 McKenzie.
12 Evans.
13 Ratcliffe.
13 Ross, M.
15 Charlton.
15 Yuill.
17 Sissons.
18 Benning.
18 Stoddart.
20 Leggatt.
21 Leavitt.
21 Morgan.
23 Macdonald, A.
24 Bell.
25 Black.
25 Parker.
27 Allison.
27 Campbell.
27 Cunningham.
30 Hutton.
30 Findlay.

Bourassa.
Harkness.
Moffatt.
Robertson, G.
McDonald, J. D.
Fierheller.
Irving.
Gilbert.
Brickwell.
Mather.
Leishman.
Waddy.
Arms.
Gibson.
Robertson, T. H.
Burk.
McLaughlin.
Harris.
Gooch.
Strong.

CLASS LISTS—EASTER EXAMINATIONS, 1895 (*Continued*)—FIRST YEAR.

Literature.

CLASS I.

1 Devitt.
2 Hodgetts.

CLASS II.

1 Craig.
2 Guy. / Parker.
4 Oastler. / Shields.
6 Nasmith.
7 Higginson. / Kennedy.
9 McKenzie.

CLASS III.

1 Reinke.
2 Wilson.
3 Ratcliffe.
4 Bard.
5 Gamble. / Kewley.
7 Gadd.
8 Roblin.
9 Bell.
10 Mather. / Sissons.
12 Charlton. / Cousins. / Morgan. / Macdonald, A.
16 Yuill.
17 Leggatt / Leishman.
19 Brickwell.
20 Cunningham. / Leavitt. / McLaughlin. / Robertson, T. H.
24 Ross, M.
25 Allison.
26 Benning. / Irving.
27 Robertson, G.
28 Christy. / Findlay. / Ross, N.
31 Campbell.
32 Hutton.
33 Evans.

Stoddart.
McDonald, J. D. / Black.
Harkness.
Harris.
Gibson.
Fierheller.
Moffatt.
Bourassa.
Arms.
Waddy.
Gilbert.
Burk.
Strong.

Grammar and Composition.

CLASS I.

1 Hodgetts.
2 Devitt.

CLASS II.

1 Guy.
2 Morgan. / Parker.
4 Kewley.
5 Craig, R. D. / McKenzie.
7 Higginson.
8 Nasmith.

CLASS III.

1 Gibson.
2 Cousins. / Sissons.
4 Robertson, G. / Roblin.
6 Bell.
7 Reinke.
8 Oastler. / Shields. / Wilson, A. F.
11 Christy. / Ross, M.
13 Harris.
14 Ratcliffe. / Kennedy. / Leggatt.
17 Moffatt. / McDonald, J.D.
19 Benning. / Bard. / Brickwell. / Robertson, T.H.
23 Charlton.
24 Allison. / Leavitt. / Leishman.
27 Mather.
28 Findlay.
29 Gamble.
30 Gadd.
31 Cunningham. / Evans. / Yuill.
34 Hutton. / Ross, N.

Harkness. / Stoddart.
Black. / Fierheller. / Irving. / Macdonald. / McLaughlin. / Bourassa. / Gilbert. / Arms. / Burk.
Cambell. / Gooch. / Waddy.
Strong.

Arithmetic.

CLASS I.

1 McKenzie.
2 Devitt.
3 Hodgetts.

CLASS II.

1 Wilson.
2 Higginson. / Nasmith.
4 Craig. / Kennedy. / Ratcliffe.
7 Bell. / Guy.
9 Gadd.

CLASS III.

1 Yuill.
2 Shields.
3 Parker. / Kewley.
5 Evans.
6 Bard. / Charlton.
8 Christy.
9 Leavitt.
10 Cousins. / Reinke.
12 Gamble.
13 Harris.
14 Cunningham. / Roblin.
16 Morgan. / Oastler.
18 Allison. / Hutton. / Mather.
21 Robertson, T.H.
22 Ross, M.
23 Arms. / Ross, N.
25 Irving.
26 Harkness.
27 Benning. / Findlay.
29 Sissons.
30 Robertson, G
31 Leggatt. / McDonald, J.D.

Bourassa. / McLaughlin. / Brickwell.
Black. / Fierheller. / Macdonald, A.
Burk. / Moffatt. / Gibson. / Stoddart. / Gamble. / Gooch. / Strong. / Gilbert. / Waddy.

Bookkeeping.

CLASS I.

1 Devitt.
2 Hodgetts.
3 Shields.
4 Guy.
5 Ratcliffe.

CLASS II.

1 Nasmith. / Hutton.
3 Bell. / Craig.
5 Bourassa. / Kewley.
7 Christy. / Higginson. / McKenzie.
10 Parker.
11 Reinke. / Sissons.
13 Charlton. / Robertson, T.H.
15 Yuill.

CLASS III.

1 Roblin.
2 Cunningham. / Gadd. / McDonald, J.D.
5 Cousins. / Oastler.
7 Brickwell. / Wilson.
9 Leishman.
10 Bard. / Gamble. / Ross, M. / Ross, N.
14 Benning. / Leavitt. / Morgan.
17 Allison.
18 Robertson, G.
19 Findlay.
20 Harkness.
21 Harris.
22 Kennedy.
23 Black. / Evans.
25 Leggatt.
26 Macdonald, A. / Stoddart.
28 Campbell. / Irving. / Moffatt.
31 Arms. / Fierheller. / Mather.

McLaughlin.
Gibson.
Gilbert.
Burk.
Strong.
Waddy.

Proficiency.

1 Hodgetts.
2 Devitt.
3 Higginson.
4 Guy.
5 Kewley.
6 Shields.
7 McKenzie.
8 Nasmith.
9 Reinke.
10 Gamble.
11 Ratcliffe.
12 Parker.
13 Oastler.
14 Wilson.
15 Christy.
16 Bard.
17 Roblin.
18 Gadd.
19 Bell.
20 Charlton. / Yuill.
22 Kennedy.
23 Ross, M.
24 Morgan.
25 Cousins.
26 Leavitt.
27 Ross, N.
28 Cunningham.
29 Sissons.
30 Leggatt.
31 Benning.
32 Evans.
33 Hutton.
34 Findlay.

CLASS LISTS—EASTER EXAMINATIONS, 1895 (*Continued*)—SECOND YEAR.

Agriculture.

CLASS I.

1 Clark, J. F.
2 Lang, L. W.
3 Paterson, T. F.
4 Butler, W. E.

CLASS II.

1 Knight, J. W.
2 McCallan, E. A.
3 Ponting, E. A.
4 McPhail, J. D.
4 McGillivray, J. W.
6 Whetter, J. R.
7 Chadsey, G. E.
8 Dunn, E.
9 Campbell, W. G.

CLASS III.

1 Thomson, J. W.
2 Tye, C. W.
2 Kipp, A.
4 Cass, L. H.
4 Taylor, W. H.
6 Smith, G. A.
7 Smith, P. B.
8 McCullough, H. A.
9 Wilson, N. F.
10 Wilson, A. C.
11 Maclennan, J. F.
12 Payne, G. Y.
13 Macpherson, G. R. B.
14 McDougall, D. H.
15 Farrer, J. W.
16 Edelsten, E. J. M.

Macpherson, D. J.
Smith, C. F.

Judging Cattle.

CLASS I.

1 Ponting.
2 Lang.
3 Paterson.
4 Clark.
4 McPhail.
6 Whetter.
7 Knight.
8 Taylor.
8 Tye.
10 Dunn.
11 Wilson, A. C.
12 Chadsey.
12 McCallan.

CLASS II.

1 Butler.
2 McCullough.
3 Payne.
4 Smith, P. B.
5 Cass.
6 Campbell.

CLASS III.

1 Kipp.
2 Macpherson.
2 Thompson.
4 Maclennan.
4 McDougall.
6 Maconachie.
7 Smith, G. A.
8 Edelsten.
9 McGillivray.
10 Wilson, N. F.
11 Farrer.

Smith, C. F.

Judging Sheep.

CLASS I.

1 Ponting.
2 McPhail.
3 Dunn.
4 Paterson.
5 Lang.
6 Clark.
7 Campbell.
7 Kipp.
9 Knight.

CLASS II.

1 Whetter.
2 Cass.
3 Thompson.
4 Butler.
4 Taylor.
6 Tye.
7 McCullough.
8 Wilson, A. C.
9 McCallan.
10 Chadsey.

CLASS III.

1 McGillivray.
2 Macpherson.
3 Smith, P. B.
4 Wilson, N. F.
5 Payne.
6 Edelsten.
7 Farrer.
8 McDougall.
8 Smith, G. A.
10 Maclennan.
11 Maconachie.

Smith, C. F.

Horticulture.

CLASS I.

1 Clark.
2 Paterson.
3 Lang.
4 McCallan.
5 Dunn.

CLASS II.

1 Butler.
2 Cass.
3 Chadsey.
3 Tye.
5 Knight.
6 Smith, G. A.
7 Campbell.
7 McCullough.

CLASS III.

1 Smith, P. B.
2 Kipp.
3 Maconachie.
4 Edelsten.
5 McPhail.
6 McGillivray.
7 Maclennan.
8 Thompson.
8 Wilson, N. F.
10 McDougall.
11 Ponting.
12 Taylor.
12 Wilson, A. C.
14 Whetter.
15 Payne.
16 Farrer.

Macpherson.
Smith, C. F.

Agricultural Chemistry.

CLASS I.

1 Clark.

CLASS II.

1 Paterson.
2 Butler.
3 Lang.

CLASS III.

1 Tye.
2 Knight.
3 McCallan.
4 Kipp.
5 Cass.
5 Thompson.
7 Wilson, N. F.
8 Campbell.
8 Chadsey.
10 McPhail.
11 McGillivray.
12 McCullough.
13 Dunn.
14 McDougall.
15 Maconachie.
16 Edelsten.
17 Taylor.
18 Smith, G. A.
19 Wilson, A. C.
20 Smith.
20 Payne.
20 Whetter.

Maclennan.
Ponting.
Macpherson.
Farrer.

Veterinary Pathology.

CLASS I.

1 Clark.
2 Lang.
3 Paterson.

CLASS II.

1 Knight.
2 Chadsey.
3 Campbell.
4 Dunn.
5 Wilson, N. F.
6 McCallan.
6 Smith, P. B.

CLASS III.

1 McCullough.
2 Smith, G. A.
3 Taylor.
4 Butler.
5 McPhail.
6 Whetter.
7 Tye.
8 McGillivray.
8 Kipp.
10 Maconachie.
11 McDougall.
12 Cass.
13 Ponting.
13 Wilson, A. C.
15 Maclennan.
16 Thompson.
17 Payne.
18 Edelsten.

Smith, C. F.
Macpherson.
Farrer.

CLASS LISTS—EASTER EXAMINATIONS, 1895 (*Continued*)—SECOND YEAR.

Practical Horse.

CLASS I.

1 Clark.

CLASS II.

1 Whetter.
2 Knight.
3 Smith, P. B.
4 Kipp.
4 Paterson.

CLASS III.

1 Thompson.
1 McPhail.
3 Cass.
4 Lang.
5 Campbell.
5 Chadsey.
5 McCallan.
5 Ponting.
9 Taylor.
10 Smith, G. A.
11 Edelsten.
12 Dunn.
13 Wilson, N. F.
14 Butler.
14 Wilson, A. C.
16 Maconachie.
16 McGillivray.
16 McCullough.
16 Tye.
16 Payne.
16 McDougall.
22 Maclennan.
22 Macpherson.

Farrer.

Literature.

CLASS I.

1 Clark.
2 Lang.
3 Maconachie.

CLASS II.

1 Smith.
2 Edelsten.
3 Paterson.
4 Knight.
5 Smith, G. A.
6 Thompson.
7 Campbell.
7 McCallan.
9 McCullough.
9 Tye.
11 Butler.
12 Cass.
13 Wilson, A. C.

CLASS III.

1 Kipp.
2 McGillivray.
3 Wilson, N. F.
4 Dunn.
5 Chadsey.
5 Payne.
7 Farrer.
8 Taylor.
9 McDougall.
10 Maclennan.
11 Ponting.
12 McPhail.
12 Whetter.

Macpherson.
Smith, C. F.

Political Economy.

CLASS I.

1 Clark.
1 Lang.
3 Paterson.
4 McCallan.

CLASS II.

1 Tye.
2 McCullough.
3 Butler.
3 Cass.

CLASS III.

1 McGillivray.
2 Kipp.
3 Edelsten.
4 Maconachie.
5 Chadsey.
6 Campbell.
7 Dunn.
8 Thompson.
9 Whetter.
10 Wilson.
11 Smith, P. B.
12 Knight.
12 Smith, G. A.
12 Wilson, A. C.
15 Maclennan.
15 McPhail.
17 Taylor.
18 Macpherson.
19 McDougall.
20 Payne.
21 Farrer.

Ponting.

Physics.

CLASS I.

1 Clark.
2 Lang.
3 Paterson.

CLASS II.

1 McCallan.
2 Chadsey.

CLASS III.

1 Dunn.
2 McGillivray.
3 Kipp.
3 McCullough.
5 Campbell.
5 Cass.
7 Knight.
8 Tye.
9 Wilson, A. C.
10 Butler.
11 Smith, G. A.
12 Smith, P. B.
13 Wilson, N. F.
14 Taylor.
15 Maclennan.
16 Maconachie.
17 Payne.
18 Thompson.
19 Edelsten.
19 Whetter.
21 Macpherson.
22 McPhail.
23 McDougall.

Ponting.
Farrer.

Drawing.

CLASS I.

1 Payne.
2 Clark.
3 Paterson.
4 McCallan.
5 Campbell.
6 Wilson, N. F.
7 McCullough.
8 Knight.

CLASS II.

1 Kipp.
2 Maclennan.
3 Tye.
4 McGillivray.
5 Lang.
5 Taylor.
7 Edelsten.
8 McDougall.
8 Smith, P. B.
10 Wilson, A. C.
11 Maconachie.
12 Whetter.
13 Cass.
14 McPhail.
15 Chadsey.
15 Macpherson.

CLASS III.

1 Thompson.
2 Smith, G. A.
3 Ponting.
4 Butler.
5 Dunn.
6 Farrer.

Smith, C. F.

Proficiency.

1 Clark.
2 Lang.
3 Paterson.
4 McCallan.
5 Knight.
6 Butler.
7 Tye.
8 Campbell.
9 Chadsey.
10 Cass.
11 Kipp.
12 Dunn.
13 McCullough.
14 Smith, P. B.
15 McPhail.
16 McGillivray.
17 Thompson.
18 Smith, G. A.
18 Whetter.
20 Wilson, N. F.
21 Taylor.
22 Maconachie.
23 Wilson, A. C.
24 Edelsten.
25 Payne.
26 McDougall.

CLASS LISTS.—MIDSUMMER EXAMINATIONS—FIRST YEAR.

Agriculture.

CLASS I.

1 Devitt.
2 Kewley.
3 Higginson.
4 Kennedy. / Gamble.
6 Gadd. / Reinke.
8 Christy. / Guy. / Hodgetts.
11 Ratcliffe.
12 Fierheller.

CLASS II.

1 Oastler.
2 Charlton. / Yuill.
4 Wilson.
5 Stoddart.
6 Morgan.
7 Bell.
8 Benning. / Shields. / Sissons.
11 Leavitt.
12 Nasmith.
13 Cousins.
14 Ross, M.

CLASS III.

1 Macdonald, A. W.
2 Campbell. / Findlay.
4 Roblin.
5 Irving.
6 Cunningham. / Ross, N.
8 Allison. / Hutton.
10 Harkness. / McDonald, J. D.
12 Bard.
13 Black. / Brickwell.
15 Harris.
16 Parker.
17 Robertson, G.
18 Gibson.
19 Whigham.
20 Arms.
21 McLaughlin. / Robertson, T. A.
23 Mather.

Leishman.
Bourassa. / Waddy.
Moffatt.
Gilbert.
Wilkes.

Dairying.

CLASS I.

1 Higginson.
2 Guy.
3 Ratcliffe.
4 Wilson.
5 Parker. / Devitt.
7 Oastler.
8 Roblin.
9 Harkness.
10 Nasmith. / Gamble.
12 Hodgetts. / Bell.
14 Kewley. / Shields.
16 Reinke. / Fierheller.
18 Allison. / Macdonald, A.
20 Gadd. / Irving. / Leavitt.

CLASS II.

1 Christy.
2 Sissons.
3 Yuill. / Leishman.
5 Cunningham. / Charlton.
7 Benning.
8 Harris.
9 Cousins.
10 Stoddart.
11 Hutton. / Kennedy.
13 Bard.

CLASS III.

1 Black.
2 Campbell.
3 Robertson, T.H
4 Morgan.
5 McDonald, J.D
6 Findlay.
7 Brickwell.
8 Robertson, G.W
9 Gibson.
10 Ross, M.
11 Mather.
12 Ross, N.
13 Arms.
14 Bourassa.

McLaughlin.
Moffatt.
Waddy.
Whigham.
Wilkes.

Poultry.

CLASS I.

1 Robertson, G.
2 Parker.
3 Shields.
4 Nasmith. / Stoddart.
6 Robertson, T.H
7 Reinke.
8 Higginson. / Leavitt.
10 Gamble.

CLASS II.

1 Kewley. / Irving. / Bell.
4 Campbell. / Bard. / Gadd. / Hodgetts. / Ross, N.
9 Yuill. / Christy.
11 Morgan. / Oastler.
13 Cunningham.
14 Wilson.
15 Devitt.
16 Ross, M.
17 Hutton. / Benning.
19 Fierhel er.
20 Roblin.

CLASS III.

1 Guy.
Ratcliffe. / Harris.
4 Allison.
5 Findlay.
6 Leishman.
7 McDonald, J.D / Cousins. / Kennedy.
10 Macdonald, A.
11 Black. / Bourassa. / Harkness.
14 Sissons.
15 Moffatt.
16 Brickwell.
17 Gibson.
18 Mather.
19 Arms.

McLaughlin.
Waddy.
Gilbert.
Whigham.
Wilkes.

Bee-keeping.

CLASS I.

1 Gadd.
2 Higginson.
3 Yuill.
4 Charlton. / Cunningham.
6 Shields.
7 Gamble.
8 Bard.
9 Allison.
10 Fierheller.
11 Ratcliffe.

CLASS II.

1 Guy.
2 Findlay.
3 Devitt.
4 Kewley. / Ross, M.
6 Hodgetts.
7 Roblin. / Hutton. / Wilson.
10 Oastler.
11 Irving.
12 Leavitt.
13 Sissons. / Black. / McDonald, J.D
16 Reinke. / Campbell.
18 Arms. / Nasmith.
20 Benning. / Kennedy. / Stoddart.
23 Bell.
24 Harkness.

CLASS III.

1 Robertson, T.H
2 Ross, N.
3 Macdonald, A. / Cousins.
5 Leishman.
6 Mather.
7 Brickwell.
8 Christy.
9 Whigham.
10 Robertson, G.
11 McLaughlin.
12 Morgan.
13 Harris. / Moffatt.
15 Gibson.
16 Parker.
17 Bourassa.

Waddy.
Wilkes, W. A.
Gilbert.

Botany.

CLASS I.

1 Hodgetts.
2 Devitt.
3 Gamble. / Stoddart.
5 Guy. / Parker.

CLASS II.

1 Ratcliffe.
2 Higginson.
3 Oastler. / Shield
5 Kewley.
6 Bard.
7 Harris.
8 Charlton.
9 Reinke. / Ross, N.

CLASS III.

1 Nasmith. / Ross, M.
3 Leavitt. / Roblin.
5 Gadd.
6 Morgan. / Wilson.
8 Allison. / Benning. / Kennedy.
11 Robertson, T.H
12 Cunningham.
13 Bell.
14 Sissons.
15 Yuill.
16 Black. / Christy.
18 Brickwell. / Cousins. / Irving. / Fierheller. / Macdonald, A.
23 Bourassa. / Robertson, G
25 Campbell. / Findlay.
27 Harkness.
28 Arms. / Hutton.

McDonald, J.D. / McLaughlin.
Leishman.
Mather.
Gibson.
Wi kes.
Gilbert.
Waddy.

CLASS LISTS.—MIDSUMMER EXAMINATIONS, 1895.—(*Continued*)
FIRST YEAR.

Materia Medica.

CLASS I.

1 Reinke.
2 Guy.

CLASS II.

1 Gamble.
2 Shields.
3 Higginson.

CLASS III.

1 Stoddart.
2 Oastler.
3 Kewley.
4 Ross, M.
5 Devitt.
6 Macdonald, A. W.
7 Leavitt. / Ratcliffe.
9 Bard.
10 Benning. / Campbell. / Gadd. / Hodgetts. / Wilson.
15 Harris. / Roblin. / Ross, N.
18 Fierheller.
19 Cousins.
20 Charlton. / Cunningham. / Irving.
23 Black. / Christy.
25 Bell. / Nasmith.
27 Kennedy.
28 Parker. / Sissons.
30 Allison.
31 Robertson, G.
32 Hutton. / Leishman. / Morgan.
35 Robertson, T. H.
36 Findlay. / Yuill.

Brickwell.
McDonald, J. D.
Harkness.
Gibson.
Mather.
McLaughlin.
Bourassa. / Whigham.
Arms.
Wilkes.
Gilbert.
Moffatt.
Waddy.

Literature.

CLASS I.

1 Hodgetts.
2 Oastler.

CLASS II.

1 McLaughlin.
2 Guy.
3 Parker.
4 Kewley.
5 Craig. / Devitt.
7 Higginson.
8 Gamble.
9 Kennedy.
10 Wilson.
11 Nasmith. / Shields.

CLASS III.

1 Brickwell. / Ross, M.
3 Charlton. / Ratcliffe.
5 Gadd. / Ross, N. / Stoddart.
8 Sissons.
9 Macdonald, A.
10 Bell.
11 Christy. / Irvin. / Mather.
14 Findlay. / Cunningham. / Roblin.
17 Gibson. / Leavitt.
19 Allison. / Bard. / Reinke.
22 Harris. / Whigham. / Robertson, G.
25 Cousins. / Leishman.
27 Benning.
28 Campbell. / Robertson, T.H
30 Hutton. / Yuill.

Morgan.
Black.
Moffatt.
McDonald, J.D
Gilbert.
Fierheller.
Harkness.
Waddy.
Bourassa.
Arms.
Wilkes.

Grammar.

CLASS I.

1 Hodgetts.
2 Devitt.

CLASS II.

1 Kewley.
2 Guy. / Higginson.
4 Craig.

CLASS III.

1 Nasmith.
2 Gibson.
3 Gamble. / Wilson.
5 Oastler. / Parker.
7 Reinke. / Roblin.
9 Cousins. / Leavitt.
11 Christy.
12 Bell. / Harkness.
14 Kennedy. / Morgan. / Sissons.
17 Irving. / Stoddart.
19 Allison. / Bard.
21 Charlton.
22 Cunningham. / Shields.
24 Benning. / Brickwell. / Ross, N.
27 Robertson, T.H / Yuill.
29 Macdonald, A. / McDonald, J.D / Ratcliffe.
32 Robertson, G.
33 Findlay. / Gadd.

Bourassa. / Ross, M.
Black.
Harris. / Mather.
Moffatt. / Hutton.
McLaughlin.
Leishman. / Whigham.
Fierheller.
Arms. / Campbell.
Gilbert.
Waddy. / Wilkes.

Composition.

CLASS I.

1 Devitt.
2 Shields.
3 Kewley.

CLASS II.

1 Hodgetts.
2 Oastler.
3 Brickwell.

CLASS III.

1 Morgan.
2 Parker. / Wilson.
4 Irving.
5 Leishman.
6 Reinke.
7 Ross, N. / Kennedy.
9 Cunningham.
10 McLaughlin. / Gadd. / Gamble.
13 Findlay.
14 Ratcliffe.
15 Benning. / Craig. / Guy.
18 Higginson.
19 Ross, M. / Mather.
21 Bard. / Bell.
23 Macdonald, A
24 Robertson, G. / Allison.
26 Stoddart.
27 Harkness / Nasmith.
29 Christy. / Yuill.
31 Whigham. / McDonald, J.D
33 Hutton. / Harris.
35 Black. / Charlton. / Cousins. / Campbell. / Leavitt. / Roblin. / Sissons.

Robertson, T.H
Fierheller.
Moffatt.
Wilkes.
Waddy.
Arms.
Gibson.
Bourassa.

Arithmetic.

CLASS I.

1 Devitt.
2 Hodgetts.

CLASS II.

1 Higginson.
2 Nasmith.
3 Kennedy.

CLASS III.

1 Cunningham.
2 Bard.
3 Hutton.
4 Ratcliffe.
5 Gadd.
6 Guy.
7 Kewley. / Sissons.
9 McDonald, J.D / Yuill.
11 Craig. / Parker.
13 Irving.
14 Allison. / Shields.
16 Oastler.
17 Christy.
18 Leavitt. / Reinke. / Roblin. / Stoddart.
22 Charlton. / Findlay. / McLaughlin.
2 Bell. / Benning. / Cousins. / Gamble. / Ross, N. / Wilson.

Robertson, T.H
Campbell.
Arms.
Morgan. / Ross, M.
Mather.
Fierheller.
Brickwell.
Bourassa.
Gibson.
Harkness / Macdonald, A.
Harris. / Whigham.
Gilbert. / Robertson,
Leishman.
Black.
Moffatt.
Waddy.
Wilkes.

See page 339 for General Proficiency.

CLASS LISTS—MIDSUMMER EXAMINATIONS, 1895 (*Continued*)—SECOND YEAR.

Agriculture.

CLASS I.

1 Clark.
2 Paterson.
3 Lang.
4 Tye.
5 Knight.

CLASS II.

1 McCallan.
2 Campbell.
3 Whetter.
4 Dunn.
5 Chadsey. / Taylor.
7 Kipp.
8 Thompson.
9 Cass. / Wilson, A. C.

CLASS III.

1 McCullough.
2 Smith, P. B.
3 Payne.
4 McGillivray.
5 McPhail.
6 Maconachie.
7 Smith, G. A.
8 Edelsten.
9 Wilson, N. F.
10 Maclennan.
11 Evans.

Dairying.

CLASS I.

1 Black.
2 Knight.
3 Campbell.
4 Paterson.
5 McCullough.
6 Lang. / Tye.

CLASS II.

1 Thompson.
2 Edelsten.
3 Whetter.
4 Cass.
5 Maconachie.
6 McCallan.
7 McPhail.

CLASS III.

1 Dunn.
2 Taylor.
3 Smith, P. B.
4 Evans.
5 McGillivray. / Kipp.
7 Chadsey. / Wilson, N. F.
9 Smith, G. A.
10 Wilson, A. C.
11 Maclennan.
12 Payne.

Poultry.

CLASS I.

1 Clark. / Knight.
3 Lang.
4 Chadsey.
5 Evans. / Whetter.
7 Payne.
8 Tye.
9 Paterson. / McCallan. / Kipp.
12 Cass.
13 Maconachie. / Dunn. / McGillivray. / McCullough.
17 Thompson.
18 McPhail. / Taylor. / Smith, G. A.
21 Campbell.

CLASS II.

1 Maclennan.
2 Wilson, N. F. / Wilson, A. C.

CLASS III.

1 Edelsten. / Smith, P. B.

Apiculture.

CLASS I.

1 Paterson.
2 Clark.
3 Campbell.
4 Tye.

CLASS II.

1 Whetter.
2 Wilson, A. C. / Knight.
4 Wilson, N. F.
5 McGillivray.
6 Thompson.
7 Lang.
8 Taylor.
9 Edelsten.
10 Smith, P. B.
11 Chadsey. / McCullough.

CLASS III.

1 Kipp.
2 Smith, G. A.
3 Maconachie.
4 McCallan.
5 Payne.
6 Dunn.
7 McPhail.
8 Evans.
9 Cass. / Maclennan.

Practical Chemistry.

CLASS I.

1 Clark.
2 Lang.
3 Cass.
4 Paterson.
5 Tye.
6 Kipp.
7 Maconachie.
8 Thompson.
9 McCullough.
10 McCallan.

CLASS II.

1 Whetter.
2 Dunn. / Knight.
4 Campbell.
5 Edelsten. / Taylor. / McGillivray.
8 Wilson, N. F.
9 Chadsey.

CLASS III.

1 Smith, P. B.
2 McPhail.
3 Wilson, A. C.
4 Smith, G. A.
5 Maclennan.
6 Evans.
7 Payne.

CLASS LISTS—MIDSUMMER EXAMINATIONS, 1895 (*Continued*)—SECOND YEAR.

Agricultural Chemistry.

CLASS I.

1 Clark.
2 Lang.

CLASS II.

1 Paterson.
2 Knight. / McCallan.
4 Thompson.

CLASS III.

1 Whetter.
2 Campbell. / Taylor.
4 Tye.
5 McCullough.
6 Payne.
7 Dunn.
8 Edelsten.
9 Cass. / McGillivray.
11 Chadsey.
12 McPhail.
13 Wilson, A. C. / Maconachie.
15 Smith, P. B.
16 Wilson, N. F.
17 Smith, G. A.
18 Kipp.

Evans.
Maclennan.
McDougall.
Macpherson.
Ponting. / Smith, C. F.

Botany.

CLASS I.

1 Clark.
2 Lang.

CLASS II.

1 Paterson.
2 Chadsey.
3 McCallan.
4 Thompson.
5 Knight.

CLASS III.

1 Kipp.
2 Smith, P. B.
3 Maconachie.
4 Cass.
5 Tye.
6 McCullough.
7 Payne.
8 Dunn.
9 Whetter.
10 Edelsten.
11 McGillivray.
12 Campbell.
13 Wilson, N. F.
14 Wilson, A. C.
15 Smith, G. A.
16 Taylor
17 McPhail.

Maclennan.
Evans.

Horticulture.

CLASS I.

1 Clark.
2 Paterson.
3 Knight.

CLASS II.

1 Lang.
2 Chadsey.
3 Campbell.
4 Tye.
5 McCallan. / Thompson.
7 Maconachie. / Smith, G. A.
9 Cass. / Smith, P. B.

CLASS III.

1 McCullough.
2 McPhail. / Taylor.
4 Dunn. / Payne.
6 Whetter. / Wilson, N. F.
8 Edelsten.
9 McGillivray. / Maclennan.
11 Wilson, A. C.
12 Kipp.
13 Evans.

McDougall.
Ponting. / Macpherson.

Veterinary Obstetrics.

CLASS I.

1 Clark.
2 Lang.
3 Paterson.

CLASS II.

1 Smith, P, B.
2 Campbell. / Whetter.
4 Wilson, N. F.
5 Chadsey. / Kipp.
7 Knight.
8 Wilson, A. C.

CLASS III.

1 Maconachie.
2 Dunn. / Thompson.
4 McCalla.
5 Evans. / Taylor. / Tye.
8 Cass. / McPhail. / Payne.
11 Edelsten. / McGillivray.
13 McCullough.
14 Smith, G. A.
15 Maclennan.

McDougall.
Ponting.

Literature.

CLASS I.

1 McCallan.
2 Clark.
3 Paterson.
4 Lang.

CLASS II.

1 Edelsten.
2 Maconachie.
3 Cass.
4 Smith, P. B.
5 Knight. / McCullough.
7 Tye.

CLASS III.

1 Smith.
2 Thompson.
2 McGillivray.
4 Campbell.
5 Chadsey. / Taylor.
7 Payne.
8 Kipp
9 Dunn. / Whetter.
11 Wilson, N. F.
12 McPhail.
14 Maclennan. / Wilson, A. C.

Evans.

CLASS LISTS—MIDSUMMER EXAMINATIONS, 1895 (*Continued*).—SECOND YEAR.

Grammar.

CLASS I.

1 Clark.
2 Lang.

CLASS II.

1 Paterson.
2 Maconachie.
3 McCullough.

CLASS III.

1 McCallan.
2 Smith, G. A.
3 Thompson.
4 Campbell. / Chadsey.
6 Wilson, A. C.
7 Cass. / Edelsten. / Knight. / Tye.
11 Payne. / Whetter. / Taylor.
14 Smith, P. B. / Wilson, N. F.
16 Dunn.
17 McGillivray. / Evans.
19 Kipp.

Maclennan.
McDougall.
Macpherson.
Ponting.

Physics.

CLASS I.

1 Clark.
2 Lang.

CLASS II.

1 Paterson.
2 McCullough.

CLASS III.

1 Tye.
2 Campbell.
3 Knight.
4 Cass.
5 Dunn. / McCallan. / Smith, G. A. / Whetter.
9 Maconachie.
10 Taylor.
11 Chadsey.
12 Kipp.
13 Payne. / Wilson, A. C.
15 Thompson.
16 Edelsten. / McPhail.
18 McGillivray.
19 Smith, P. B.
20 Evans.
21 Wilson, N. F.

Maclennan.

Road-making.

CLASS III.

1 Paterson. / Clark.
3 Wilson, A. C.
4 Wilson, N. F. / Whetter. / Tye.
7 Payne.
8 Knight. / Taylor. / Dunn. / McCallan. / Maconachie.
13 McCullough. / Lang. / Edelsten.
16 McPhail. / Chadsey. / Thompson. / Evans. / Kipp. / Campbell. / McGillivray.
23 MacLennan.
24 Smith, G. A.
25 Cass.
26 Smith, P. B.

Second year proficiency.

1 Clark.
2 Lang.
3 Paterson.
4 Knight.
5 McCallan.
6 Tye.
7 Campbell.
8 Thompson.
9 McCullough.
10 Maconachie.
11 Cass.
12 Whetter.
13 Chadsey.
14 Kipp.
15 Dunn.
16 Taylor.
17 Edelsten.
18 Smith, P. B.
19 McGillivray.
20 Wilson, A. C.
21 Smith, G. A.
22 Payne.
23 Wilson, N. F.
24 McPhail.

First year proficiency.

1 Devitt.
2 Hodgetts.
3 Higginson.
4 Kewley.
5 Guy.
6 Shields.
7 Gamble.
8 Oastler.
9 Reinke.
10 Nasmith.
11 Charlton.
12 Ratcliffe.
13 Wilson.
14 Gadd.
15 Parker.
16 Stoddart.
17 Kennedy.
18 Bard.
19 Cunningham.
20 Leavitt.
21 Bell.
22 Irving.
23 Roblin.
24 Yuill.
25 Christy.
26 Benning.
27 Allison.
28 Ross, N.
29 Sissons.
30 Cousins.
31 Findlay.

DAIRY SCHOOL STUDENTS CLASS LISTS.—GENERAL PROFICIENCY, 1895.

Class I.	Class II.	Class III.
1 Smith, H.	1 Hill, J. A.	1 Dennis, R. B. / Richardson, D.
2 Boyes, F.	2 Millar, J. T.	3 McGarry, W. R.
3 Scott, J. H.	3 Travis, C.	4 Code, B. / Medd, W. G.
4 Waddell, Wm.	4 McDonald, T. W.	6 Marquette, G. W.
5 Jeffs, C. B.	5 Mitchell, H.	7 Cowieson, W. R.
6 James, D. A.	6 Travis, F. E.	8 Robeson, J.
7 Stonehouse, J.	7 Carlaw, G.	9 Aiken, R. J.
8 Chalmers, A.	8 Malcolm, R.	10 Campbell, Miss E. M.
9 Mitchell, W. H.	9 Weir, Wm.	11 Metcalfe, G. / Parker, A. A.
	10 McCallum, L. C.	13 Westphall, A. A.
	11 Baird, A. K.	14 Smith, E. P. / Traviss, C. H.
	12 Biggin, E. O.	16 Heeks, H.
	13 Singleton, Wm.	17 Humphrey, Geo.
	14 Henricks, K.	
	15 Rendall, Wm.	
	16 Laird, J. G.	
	17 Stillman, Robt.	
	18 Christie, Jas.	
	19 Smyth, F. L.	
	20 Coomber, H.	
	21 Carson, W. J. / Tucker, G. E.	
	23 Shorey, S. C.	
	24 Reist, F. B.	
	25 McDonald, W. J.	
	26 Campbell, A.	
	27 Hill, G. W.	
	28 Elliott, Wm. / Marshall, T. B.	
	30 King, R. B.	
	31 Jackson, Miss L.	

APPENDIX V.

FINANCIAL STATEMENT FOR 1895.

I. College Expenditure.

(*a*) *College Maintenance.*

1. *Salaries and Wages*		$17,685 35
2. *Food*—		
Meat, fish, and fowl		3,727 04
Bread, biscuits, etc		690 26
Groceries, butter, and fruit		4,487 53
3. *Household Expenses*—		
Laundry, soap and cleaning		179 82
Women servants' wages—cooks, laundresses, housemaids, etc		1,901 85
4. *Business Department*—		
Advertising, printing, postage and stationery		1,223 88
5. *Miscellaneous*—		
Chemicals, apparatus, etc., used in laboratories		622 67
Library and reading-room—books, papers, and periodicals		364 44
Medals		92 16
Unenumerated		602 10
		$31,577 10

(*b*) *Maintenance and Repairs of Government Buildings.*

Furniture and furnishings	$1,635 36	
Repairs and alterations	1,478 73	
Fuel	2,036 00	
Light	695 53	
Water	650 00	
Disposal of sewage	199 23	
		6,694 85
		$38,271 95

College Revenue.

Fees	$1,597 00	
Balances for board, after deducting allowances for work in outside departments	5,080 86	
Supplemental examinations	54 00	
Gas and chemicals	67 00	
Contingencies—fines, breakage, etc	206 44	
Analysis of soil	5 00	
Sale of bones, drippings, etc	22 74	
Stationery	3 38	
		7,036 42
Net expenditure of College and Government Buildings		$31,235 53

The net sum voted by the Legislature for the College and the maintenance and repairs of Government Buildings (See Estimates for 1895, pp. 36 and 42) was $31,311.00. Hence the unexpended balance under this head in 1895 was $75.47.

II. Farm Expenditure.

(*a*) *Farm Proper.*

1. *Permanent Improvements*—		
Fencing, underdraining, etc		456 62

2. *Farm Maintenance*—

Salary of Superintendent	$1,200 00	
Wages—herdsmen, teamsters, engineer, etc.	2,771 83	
Live stock	1,154 93	
Maintenance of stock	907 06	
Seed	282 08	
Binding twine	15 47	
Repairs and alterations, including blacksmithing	438 26	
Furniture, furnishings, etc.	219 26	
Tools and implements	307 49	
Advertising, printing, postage, and stationery	186 89	
Fuel and light	57 91	
Contingencies	64 20	
		7,605 38
		$8,062 00

Cash Revenue of Farm Proper.

Sales of cattle	$2,150 05	
" sheep	438 80	
" pigs	1,067 31	
" wool	68 61	
" hides	3 10	
" milk	151 96	
" wheat	309 15	
" oats	388 70	
" barley	288 24	
" old fence	55 28	
Service of animals	134 00	
Rent of pasture	12 00	
Screenings	5 80	
Sheep skins	1 80	
Potatoes	9 50	
		5,084 30
Net expenditure of farm proper		$2,977 70

Unexpended balance for the year, $2,197.30. (See Estimates, p. 37.)

(*b*) *Experimental Plots and Feeding.*

1. *Permanent Improvements*—

Experimental piggery, stable and sheep shed; bath and alterations therefor in Experimentalist's house; and certain furnishings in new Experimental Building	912 90

2. *Maintenance*—

Salaries and wages—

Experimentalist	$1,500 00	
Experimental foreman	400 01	
Labor	2,313 34	
Seed	361 51	
Manure and special fertilizers	85 75	
Furniture, furnishings, and repairs	147 36	
Printing, postage, and stationery	97 99	
Implements	124 89	
Contingencies	168 21	
		5,201 06
		$6,111 96

Unexpended balance for the year, $1,295.04. (See Estimates, p. 37.)

III. Dairy Department.

(*a*) *Experimental Dairy.*

Salary of foreman	$650 00	
Experimental cheese-maker (9½ months)	425 00	
Man to assist in experimental work, attend boilers, etc.	255 00	
Assistant chemists, employed in analyzing milk, whey, cheese, etc.	462 50	
Cattleman, milkers, etc.	649 12	
Temporary assistance	99 98	
	2,541 60	

Purchase of milk for experimental cheese-making	$1,575 37	
" cows and pigs	268 50	
Feed and fodder	1,037 78	
Furniture, furnishings, and repairs	550 96	
Laboratory expenses—gas, chemicals, etc	139 72	
Advertising, printing, postage, and stationery	99 54	
Fuel	399 14	
Contingencies	140 23	
		$6,752 84

Revenue of Experimental Dairy.

Sales of butter	$1,211 31	
" cheese	768 78	
" milk	115 74	
" cream, skim-milk, whey, and butter-milk	43 11	
" cattle	87 50	
" pigs	476 94	
" hides	1 80	
" old milk-tester	2 00	
		2,707 18
		$4,045 66

Unexpended balance for the year, $784.34. (See Estimates, p. 38.)

(*b*) *Dairy School.*

Wages of instructors, engineer, and general help	$1,351 93	
Purchase of milk for use in School	5,018 80	
Dairy utensils, supplies, and repairs	458 23	
		6,828 96

Revenue of Dairy School.

Fees	$ 468 00	
Sales of butter	2,241 72	
" cheese	823 83	
" skim-milk	194 20	
		3,727 75
		$3,101 21

Unexpended balance for the year, $848.79. (See Estimates, p. 38.)

(*c*) *Travelling Dairy.*

Expenses of Travelling Dairy	$2,371 30

Unexpended balance for the year, $428.70. (See Estimates, p. 38.)

IV. Poultry Department.

Salary of manager	$ 700 00	
Purchase of stock	176 65	
Furnishings	123 71	
Feed, etc	166 72	
Fuel and light	48 20	
Temporary assistance	26 70	
	$1,241 98	

Revenue.

Fees	$ 5 00	
Sales of fowl	122 89	
" eggs	59 75	
	$187 64	
		$1,054 34

Unexpended balance for the year, $115.66 (See Estimates, p. 38).

V. Horticultural Department—Garden, Greenhouses, Lawn, Arboretum, Forest-Tree Clumps, &c.

1. *Permanent Improvements*—Underdraining, fencing, etc	$288 19
2. *Maintenance*—	
Salary of foreman and head gardener	$ 650 00
Assistant gardener and florist	527 98
Assistant in greenhouses	380 00
Teamster and laborers	1,689 40
	$3,247 38

Manure	$ 44 60	
Seeds, bulbs, plants, shrubs, trees, etc	180 95	
Furniture, furnishing, repairs, tools, implements, flower pots, etc	317 64	
Fuel and light	469 83	
Contingencies	60 78	
		$4,321 18

Unexpended balance for the year, $458.63 (See Estimates, p. 38) $4,609 37

VI.—Mechanical Department.

Salary of foreman	$700 00	
Salary of extra carpenter for erection of buildings, etc	650 00	
Tools, etc	49 70	
Fuel	6 95	
		$1,406 65

Unexpended balance, $18.35 (See Estimates, p. 39).

Summmary.

Total net expenditure of all departments in 1895—

I. College and Government Buildings	$31,235 53
II. Farm—	
1. Farm proper	2,977 70
2. Experimental plots and feeding	6,111 96
3. Dairy department—experimental dairy, dairy school, and travelling dairy	9,518 17
4. Poultry department—wages, stock, etc	1,054 34
III. Horticultural department—garden, greenhouses, orchards, lawn, aboretum, etc	4,600 37
IV. Mechanical department—construction of buildings, repairs, etc	1,406 65
	$56,913 72

Unexpected balances on the year's operations in all departments, $6,222.28

The amount paid by the College to students for work in the outside departments in 1895, was $3,321.89. This was done by crediting on board bills the sums allowed to students from week to week by the foremen under whom they worked.

Notes on Statement

Without going into a formal statement of accounts between different departments, I may say that *the Farm Proper is entitled to credit* from several of the other departments—

(1) From the College for feed and bedding of College horses; the filling of the College ice house; a large quantity of milk (varying from thirty to seventy quarts a day), and potatoes, turnips, etc., for College use.

(2) From the Dairy Department for ensilage and mangels, and the years's supply of pasture, hay, and straw for thirty cows, ten to twelve calves and a number of swine.

(3) From the Poultry Department for straw, chaff, mangels, etc.

(4) From the Experimental Department for the feed and bedding of four horses throughout the year.

(5) From the Horticultural Department for feed and bedding of two horses throughout the year.

It is also right to add in this connection, that the farm proper keeps a number of male animals—bulls, rams, and boars—solely for educational purposes. Twenty-three or more of these animals are fed and cared for from year to year at large expense, when three would serve all the requirements of the farm superintendent for breeding. This is a large item of expense which the farm superintendent has to incur every year for the benefit of the College, that the students may have the means of getting a thoroughly practical knowledge of live stock—that they may have both male and female of all the principal breeds of farm animals for daily inspection and class-room work. See Superintendent's statement, part XI. of this report.

The Horticultural Department is also entitled to credit for a regular supply of fruit vegetables, and flowers to the College throughout the year, and a large amount of work of man and team in grading and hauling sod and gravel for Dairy, Poultry, and Experimental Departments.

JAMES MILLS,
President

APPENDIX VI.

SEVENTEENTH ANNUAL REPORT

OF THE

ONTARIO AGRICULTURAL AND EXPERIMENTAL UNION.

The Seventeenth Annual Meeting of the Ontario Agricultural and Experimental Union was held at the Agricultural College, Guelph, on the 12th and 13th of December, commencing at 10 a.m. on the 12th.

Mr. C. A. KEIL, President, occupied the chair, and opened the meeting in good time. The attendance at the opening session was the largest it has been for several years.

REPORT OF COMMITTEES.

Mr. E. LICK, Oshawa: In regard to securing an increased grant to the Union, I might say that I was one of the committee appointed at the last annual meeting to interview the Minister of Agriculture, and endeavor to have the grant to the Union increased $300 for 1895. Mr. N. Monteith and I saw the Hon. Mr. Dryden at the time of the Central Farmers' Institute, in Toronto, and I am pleased to state that the grant to the Union has been increased by $250 during the past year.

SECRETARYSHIP.

Mr. R. F. HOLTERMANN, Brantford: There is a matter which I wish to bring before the meeting, and that is in regard to the secretaryship of the Union. I have now held the office for several years, but find it is almost impossible to perform the duties connected therewith, and therefore desire to ask the Union to release me from the office. I wish to thank the Union for electing me as Secretary for so many years.

REVISION OF CONSTITUTION.

Mr. R. F. HOLTERMANN: The Ontario Agricultural and Experimental Union now comes under the Agriculture and Arts Act, as revised in 1895. After the present year it will be necessary to make our membership fee one dollar per year. I suggest that arrangements be made for all members to receive the *O. A. C. Review* free of charge, if the membership fee to the Union is placed at one dollar. A similar practice to this is done by several of the other associations.

Moved by Mr. R. F. HOLTERMANN and seconded by Mr. T. G. RAYNOR, That the constitution of the Ontario Agricultural and Experimental Union be revised to meet the requirements of the Agriculture and Arts Act, and that E. Lick, C. A. Zavitz and A. Shantz be a committee to make the necessary revision and report to this meeting. After the name of Mr. Holtermann was added to the list the resolution was carried.

PRESIDENT'S ADDRESS.

The President, Mr. C. A. KEIL, Chatham, then delivered the following address:

Another year has almost passed and gone with its many changes, since we last assembled in the capacity of our Experimental Union. We cordially welcome you to this the seventeenth annual meeting of the Ontario Agricultural and Experimental Union, and I trust we will all do our best to make this the most useful and interesting meeting yet held. The past season has been a most trying one to the agriculturists of this Province. We had a very severe frost in May, doing great damage, and this was followed by one of the driest seasons that this country has ever experienced. The past season has fully demonstrated the value of growing soiling crops, and especially corn.

Our work has been increasing each succeeding year since the Union launched out in experimental work. In 1885 there were but twelve experimenters, in 1894 there were over one thousand three hundred and forty, and during the past season about two thousand experimenters were engaged in the good work. How much farther we shall extend operations I shall not forecast, but our work is only limited by our means. This year we had a grant of $950; which, I believe, has been well spent, and will result in a vast amount of benefit to our Province. I have never yet heard our work adversely criticized, and it is surprising what an interest farmers take in our experiments. I speak from personal observation. The enquiry for Dawson's Golden Chaff wheat for seed last fall was something wonderful. Let us be more thorough and more exact, if possible, in conducting our experiments, so that we will have a larger percentage of complete returns sent in, and so that there can be no doubt that the results are absolutely correct. Subsoiling has been much recommended as a means of combatting weeds, and perhaps the Union could experiment along this line. Every ex-student who engages in agriculture, of whatever branch, should be a member of this Union, and should carry on some line of experimental work. There are many things that can be learned by observation, experience, and experiment, which cannot be learned at college, and our education should continue throughout our lives; and not stop when we leave these College walls. The future of our alma mater lies in the conduct of her ex-students, and I believe the ex-students, as a rule, are doing credit to this College. I think the chief reason that more farmers' sons do not attend the Agricultural College is because they can *get along* without taking a course at this place. In almost all other professions and trades one *has to* go through a prescribed course of study, and come up to a certain standard before he can follow his calling; but this is not so with ordinary farming. The idea still largely prevails that anybody is good enough to farm, but I believe this state of things is rapidly passing away. Too many farmers are still more intent on getting a farm for the boy than of improving his mind. If the farmers of this country wish to take the position that many are now clamoring for, they must become better educated before they can do so. The farmer who would succeed in these times of glutted markets, and low prices, must combine science with practice; he must work with his head as well as with his hands; he must study how to produce the largest quantity and best quality of any articles at the least possible cost; he must produce more per acre than he has done in the past, whether it be fruit, grain, live stock, or their products. The time has come when we must specialize more. The average human being has not brains enough to thoroughly master all the different branches of agriculture and make a success of them. While it is well to follow mixed farming to a certain extent, we should make a specialty of some particular line that is to our liking. If we have too many irons in the fire some are apt to get burned.

A great many farmers have too much land. They spread a limited amount of work over a large area, and get very poor results. One thing well done is worth half a dozen half done, and will be a source of pride and satisfaction to the doer. Let us, the members of this Union, uphold the dignity of our calling.

I conclusion I thank you, gentlemen, for electing me to this honorable office, and hope that in the future we may attain unto even greater usefulness in our experimental work.

PROFITS IN POULTRY ON THE FARM.

BY H. J. PAGE, ST. MARYS, ONT.

The question is often asked: "Does it pay to raise and keep poultry on the farm?" This depends entirely on circumstances. If poultry are left entirely to shift for themselves, I would answer this question with an emphatic "No;" but if properly managed and given a good coop in which to roost comfortably at night, I would answer the question just as emphatically, "Yes."

It must be understood that it is the farmer and not the fancier I am talking to, and that I have based my calculations on the average prices of cost and production, For easy calculation I have assumed that the average flock of hens on a farm is one hundred. Some flocks I know are larger, and some, I am sorry to say, are very much smaller. I am also assuming that we are calculating on egg production, and that the best breeds for this purpose are kept, most of which will average from 125 to 175 eggs per year. I have placed the production per hen just half-way between those figures, viz, 150. This number can be obtained without anything approaching to extra trouble and I feel convinced that with a little extra care each hen would lay from five to ten eggs more than I have given them credit for.

Now as we are simply calculating on the production of eggs I think the following breeds are the best to keep: Minorcas, Wyandottes, Houdans and Javas, the three last mentioned breeds being exceptionally good winter layers, producing eggs at the time when the highest price can be obtained for them. Then, as uniformity of eggs for sale is always desirable, only one breed should be kept and that as thoroughbred as possible. With regard to the Javas, I would say that they make superior birds for the table, are very hardy, and are easily raised and for those reasons are much to be preferred. As Guelph is what may be termed the Canadian home of the Java, stock of this breed should not be difficult to obtain. Some of the very finest specimens of this breed can be seen in this institution.

When starting a flock, procure your stock from some reliable person, who is breeding birds for egg production alone, as very often the best show birds are not the best layers, and I wish it to be distinctly understood that the best stock for this purpose can be obtained in Canada. We do not require to import.

Now I am assuming that one or the other of the breeds I have mentioned is kept, and an account of receipts and disbursements is also kept. I think a fair estimate of results obtainable will be shown in the figures I am about to give you. I have carried the account on for a period of five years, as I am assuming that the poultry department of the farm is started by borrowing from the rest of the farm, and has to be kept going for that period in order to clear off the mortgage.

FIRST YEAR.

18.....	Dr.	Amount. $ c.	18.....	Cr.	Amount. $ c.
1st Jan..	To stock, 100 hens at 50c	50 00	31st Dec	By 14,250 eggs at 1c.....	142 50
	To cost to build coop	50 00		By 3 bbls manure, 140 lbs to bbl	3 00
	To feed for one year @ 70c. each	70 00		By value of coop.....	50 00
	To sand and lime	2 00		By value of stock.....	50 00
	To rent of one acre of land....	5 00			
	To 7 per cent. interest on $100..	7 00			
	To profit on investment	61 50			
		$245 50			$245 00

SECOND YEAR.

18.....	Dr.	Amount $ c.	18.....	Cr.	Amount. $ c.
1st Jan..	To value of stock at end of last year	50 00	1st Jan..	By balance from last year.	56 50
	To value of coop	50 00	31st Dec	By 14,000 eggs @ 1c	140 00
	To feed for year	70 00		By 3 barrels (140 lbs) manure @ $1 00	3 00
	To rent of land	5 00		By 50 pullets raised and placed in stock	25 00
	To sand, lime, sulphur, etc	2 00		By young male birds for sale or use	12 50
	To interest on $100	7 00		By 50 of old stock sold off or used	12 50
	To cost to raise young stock	25 00		By 50 of old stock kept	25 00
	To repaid loan of $100	100 00		By value of coop	50 00
	Balance credit	19 50			
		$324 50			$324 50

THIRD YEAR.

1st Jan.	To stock at end of last year	50 00	1st Jan..	By credit last year	19 50
	To feed for year	70 00	31st Dec	By 14,000 eggs @ 1c	140 00
	To sand, lime etc. etc	2 00		By 3 barrels (140 lbs) manure	3 00
	To rent of land	5 00		By 50 pullets raised and placed in stock	25 00
	To cost of raising young stock	25 00		By 50 young male birds sold off or used	12 50
	Balance credit	85 50		By 50 of old stock sold	12 50
				By 50 stock carried over, first pullets raised	25 00
		$237 50			$237 50

FOURTH YEAR.

1st Jan..	To value of stock	50 00	1st Jan..	By credit last year	85 50
	To feed	70 00	31st Dec	By 14,000 eggs	140 00
	To lime, sand, &c	2 00		By 3 barrels manure	3 00
	To rent	5 00		By 50 young pullets raised and put in stock	25 00
	To 2 thoroughbred roosters for changing stock	4 00		By 50 of old stock carried over	25 00
	To cost of raising young stock	25 00		By 50 of old stock sold off	12 50
	Balance credit	147 50		By 50 young male birds sold off	12 50
		$303 50			$303 50

FIFTH YEAR.

1st Jan..	To value of stock	$50 00	1st Jan .	By credit last year	$147 50
	To feed	70 00	31st Dec	By 14,000 eggs	140 00
	To lime, sand, etc	2 00		By 3 barrels manure	3 00
	To rent	5 00		By 50 pullets added to stock	25 00
	To cost of raising young stock	25 00		By 50 old stock kept	25 00
	Balance credit	213 50		By 50 old stock sold	12 50
				By 50 young males sold	12 50
		$365 50			$365 50

I suppose better prices might be obtained from the sale of hens culled from the flocks, if near cities or large towns, and also for the young male birds. We will now take stock, and we find that we have—

Cash on hand	$213 50
Coop valued at	45 00
100 fowls value	50 00
Total	$308 50

This shows a clear yearly profit of $61.70 on this one acre of land devoted to poultry, and I think I have demonstrated that it does pay to keep poultry on the farm if properly managed. Flocks of thoroughbred hens may be improved in the direction desired by selecting those birds having the greatest percentage of the desired qualifications, and breeding from them only. Flocks of any common stock may be improved by introducing a few thoroughbred male birds and selecting the best hens to breed from. It is just as necessary to make careful selections in the poultry yard as it is for the diaryman to save only the calves from his best cows in order to improve his herd.

Coop and Equipment.

The coop should be of sufficient size to prevent crowding. It should also be weather-tight and free from drafts, but at the same time be well ventilated and have plenty of light. There is an old proverb which says "Where the sun does not enter the doctor does." This applies as much to the hen coop as it does to human dwellings, therefore, let in as much sunlight as possible, and in order to do this, place your windows so as to face as near as you can to the south-east. Right here I might say that one of the chief reasons for live stock not thriving as well in winter as in summer is the want of fresh air and sunlight. The perches should be made of 4 x 4 scantling rounded off at the corners and at the upper side and should not be higher than three feet from the ground, as high perches are injurious. A dust bath must be provided and should be placed so that the sun will shine directly on it for a good part of the day. This will induce the fowls to dust themselves, which is one of the best ways to prevent vermin. The best thing to fill this bath with is road dust in which a little flowers of sulphur has been mixed. Part of the floor should be so arranged as to allow of sand or gravel or even straw or chaff to be spread a few inches deep in order to induce fowls to scratch. Nest-boxes must also be supplied in sufficient numbers. The best nest-boxes and water fountains I have seen are those in use at this institution, as they can be easily removed for cleaning.

When going into a business of any kind it is always advisable to observe the methods and profit by the experience of those who have made the greatest success of that business, and the poultry business is no exception to this rule, and as the French have made the greatest success of the poultry business, I think if we follow as closely as possible in their footsteps we shall be more likely to succeed than by any other method. Climatic conditions are of course different, so that we cannot follow them to the letter, but we can keep very close to them.

An abundance of fresh hard water should be supplied, as hard water contains lime and magnesia in just the proportions required for the formation of bone and egg shells. This of course should be supplemented by ground bone or some other substance such as the scale taken from steam boilers, or better still, the substance taken out of the heaters used in large steam plants, and which may be had for taking away.

The morning meal should consist of vegetables of any kind boiled and mixed with shorts or chop, and fed warm in such quantity as they will eat up clean. The noon meal should be a light one, and consist of barley and oats scattered through the litter on the floor of the coop. Exercise is very necessary, and here they will get it. The evening meal should consist of whole grain, such as wheat or corn with a little buckwheat mixed with it, as buckwheat is one of the best egg foods known. Skimmed milk or butter-milk mixed in the morning meal, and any available meat scraps will supply animal food which is very necessary.

Always keep a box of fine gravel in the coop, so that the fowls can obtain the necessary grit. This grit enters the gizzard and acts as a mill to grind the food, taking, in fact, the place of the hen's teeth, which we often hear about, but never see.

Before closing this paper, I would like to call your attention to the fact that poultry keeping is a source of national wealth, as, apart from the vast quantities used in the country, large quantities are exported every year. From the little town of St. Mary's alone, there have been shipped to Great Britain, since August the 26th last up to the present time, 38 car-loads of eggs, each car containing 12,000 dozen, thus making in all 456,000 dozen, or 5,472,000 eggs, valued at $55,000.

An American paper lately stated that the hen added yearly to the wealth of the United States in eggs alone not less than $135,000,000, equalling the value of the combined output of iron and wool.

Q. How do you feed the scale you mentioned?

Mr. PAGE: I pulverize it and mix it with the morning meal.

Q. Do you think it a drawback not to wash the drinking fountains inside?

Mr. PAGE: I would prefer having them washed out.

Q. Which is the best bone mill in Canada?

Mr. PAGE: There are several mills made in Canada. I would not like to say which is the best.

Q. Is there any danger in putting too much of the mixture you mentioned in the morning feed?

Mr. PAGE: No.

Q. Do you believe in tar paper?

Mr. PAGE: Tar paper will take up moisture.

Mr. PETTIT: I wish to say that I am very much pleased with the paper Mr. Page has given us. There are no overdrawn statements. Now, with regard to warmth of henhouses, tar papering is a mistake. Two years ago I built a henhouse and tar-papered it up and down, covered that over and tar-papered it up and down again. I do not think it is beneficial. I think it it is a mistake. I do not think there is anything gained.

Mr. GRAHAM: I may say that this subject of poultry raising is of great importance to the farmers of Ontario. If farmers could get chickens out early they would get a very high price for them in the American markets—as high as forty cents per pound. Use lots of meat to get eggs in winter. Give your hens plenty of exercise. Keep them right down to work. Give them plenty to eat. I may say, in regard to getting eggs in winter-time, that you must have warm houses. I have not much trouble in getting eggs at that season.

The question has been raised, "Is tar-paper good for henhouses?" My houses are built of four thicknesses of rough lumber and two of tarred felt. They are three feet six inches high in front, and five feet in the rear, with a thirteen foot rafter sloping southward, and a five foot rafter northward. This gives the heat of the sun a chance to warm up the houses during the day. About one-third of the front is glass. The roof is sheated with two thicknesses of tarred felt in opposite directions, then covered with rough lumber running lengthwise. This has not leaked as yet and is very cheap. There is a walk three feet wide in the rear running the full length of the building, Trap doors open from the pens so that the eggs can be removed without disturbing the hens.

Q. I would like to ask Mr. Graham what variety of poultry he counts best for profit?

Mr. GRAHAM: When I was in the State of Michigan, on one of the largest poultry farms that they had, pullets that were hatched on the 16th of April, commenced laying on the 20th of September. Fifty-five of these pullets averaged about twenty-five eggs a day from that time through the winter and spring, and they would sometimes get three

dozen and sometimes four dozen eggs from these fiftv-five pullets daily. They were Plymouth Rocks. I am breeding Plymouth Rocks, Wyandottes and Indian Game. These are good winter layers. They grow very rapidly and are extra hardy.

Q. What kind of Plymouth Rocks?

Mr. GRAHAM: Barred.

Q. Have you any experience with Javas?

Mr. GRAHAM: I have had some experience with Javas. I liked them very well but for their color, it being the black variety which I bred. This color always shows dressed goods to disadvantage if picked when pin feathers are plentiful, while the light breeds do not.

Q. Do you consider it a great disadvantage not being able to wash the drinking fountain on the inside?

Mr. PAGE: While I do not consider it a serious drawback, I would prefer being able to wash them out.

Q. In regard to building poultry houses, do you think it advisable to tar the boards inside the coop.

Mr. PAGE: Yes I think tarring beneficial, as it tends to keep the coop dry.

QUESTION DRAWER.

Q. What do you consider the best feed for ewes in lamb in winter?

Mr. RENNIE, Agricultural College: We fed our breeding ewes during winter months as follows: A mixture of corn silage, pulped roots and chaff and a little bran morning and evening, and at noon peastraw, and for two or three weeks before lambing in the spring more bran was mixed with the feed. They were all in good healthy and thrifty condition.

Q. Does it pay to house milch cows during the day in summer time?

Mr. SLEIGHTHOLM: There is nothing to-day in connection with our live stock interests that has more to do with dollars and cents than this one thing. I talked with a man who handles about forty milch cows, improved grades principally, to get information that would enable me to get rid of the ravages of the hornfly. He tried nearly everything; but as for housing, he said a farmer with ten cows could not afford to do it. One year I tried housing our cows during the daytime. I started keeping the cows in about the first week in August to get rid of the hornfly, and fed them with green fodder at noon and night during the summer months, and in one night our supply of milk increased one-third. It is best to house milch cows, despite what people say on this question. Not many years ago I tried greasing; then I got a spray pump, small one, and sprinkled the cows all over. I also used horn application. That did not work; so I gave up in disgust the trying to get rid of the hornfly by using applications.

Mr. RENNIE: I would recommend housing milch cows twice a day, for milking, and feeding them ensilage in addition to the pasture they are getting. During the summer, when the hornfly is troublesome, rub them all over once a week with a mixture of seal oil and carbolic acid; a small tablespoonful of the latter to a quart of the former.

A MEMBER: In our ordinary farm practice we bring our cows in the stables about five o'clock in the morning. They are kept in during the daytime and turned out at night, and from our own experience, and from what I hear others say, I find it is a most excellent preventive of the ravages of the hornfly.

Q, What is the value of a ton of meadow muck as compared with a ton of farmyard manure of average quality?

Prof. SHUTTLEWORTH: Farmyard manure is a general manure, that is, it contains all the plant food constituents; but muck is valuable chiefly for its nitrogen, as it contains very little potash and phosphoric acid. The value of the muck would depend upon its nitrogen, and it would need to be used where nitrogen is required. Practically speaking, one ton of muck would be worth from one-eight to three-eights that of a ton of farmyard manure.

Q. What do you consider the best method of dressing poultry for market?

Mr. PAGE: For an answer to this question I would refer you to Mr. Graham, who is more conversant with that part of the business than I am.

Mr. GRAHAM: When poultry is dressed for shipment to distant points, and where it comes in competition with local goods, it must present as nearly as possible similiar appearance. Fast the birds intended for slaughter about eight hours. Kill by cutting a deep gash in the roof of the mouth, immediately under the eyes. Commence picking at once, (all kinds must be dry-picked), being careful not to tear the flesh. When picking is done, wash the head and all bloody parts in clean water; then put the bird in cold water, but not ice cold, and allow to remain there about fifteen minutes; then remove to a barrel containing floating ice, there let it remain for twelve hours, when it will be ready to pack. Should there be any contents in the crops remove and sew up carefully, so as not to mar the appearance. None should be drawn, as our American friend wants undrawn. In packing, take an ordinary sugar barrel washed clean, put a thin layer of ice in the bottom, then put in your chickens, head downwards and feet toward the center, leaving a small space around the edge of the barrel which should be filled with ice. In between each layer of fowls put a little ice, and on top cover with fine ice, and cap with a large piece, then cover all with a piece of linen. Poultry packed thus will usually stand shipment for eighteen hours. Be careful and keep all filth away from all parts. Never dress poor birds as they will not sell to advantage.

Q. What about ground bone?

Mr. GRAHAM: Ground bone is almost a necessity where good strong fertile eggs are expected in winter. It is of great value in increasing the number of eggs. When a bone cutter cannot be afforded, the liver, lights and refuse matter from the butcher shop may be cooked in feed, and in this way partially supply the food in the bone. Bone acts as grit as well as food, avoids soft-shell eggs, and many diseases. I am using a bone cutter; it does its work well, and is very satisfactory. I have tried no others so cannot say anything further.

Q. Which is the best incubator?

Mr. PAGE: I do not know which is the best incubator in use, but men who have been in the poultry business most of their lives cannot always depend on making a successful hatch with the incubator, I could not advise a farmer to invest. I do not think the incubator has arrived at that state of perfection when it can be left for any length of time to care for itself.

Mr. GRAHAM: This is a very difficult question to answer, and one which is probably beyond my ability. However there are a few things to be considered in purchasing an incubator. (*a*) It should be self-regulating; (*b*) it should be double-cased in order that the outer atmosphere, if changeable will have little or no effect on the egg-drawer; (*c*) it should be simple in its management.

TESTS WITH FIVE-BANDED ITALIAN BEES.

R. F. HOLTERMANN, Brantford, Ont., Director of co-operative experiments in agriculture, said: In considering the results from five-banded Italian bees, it must be remembered that the season of 1895 was almost a total failure as regards the honey flow. There can, therefore, be but little comparison between the honey-gathering qualities of the various strains of bees. Other marked traits appear to have been reasonably well

established, some having been suspected before. Two very close observers report that the bees appear to have difficulty in locating themselves. As far as we know, no one has ever reported to that effect before, and it may be well to ask experimenters during the season of 1896 to pay special attention and report in regard to the above.

The tendency to supersede queens was reported at the last meeting. The reports this season do not mention any difficulty in this direction during the season of 1895. The difficulty in 1894 may have been due to the long journeys the queens underwent before introduction.

It is quite impossible to tabulate the various reports, and as they are not lengthy it would be as well to publish them in full. They are as follows:

Individual Reports of Five-Banded Bees.

S. T. Pettit, Belmont: My report of the five-banded bees is that the queen is prolific and the bees seem industrious, but they do not get numerically strong from some cause, no matter how much cared for and fed. Another unfavorable peculiarity is that they do not seem to have the power to locate themselves very well. Many bees returning miss their own hive and get into adjacent hives and are killed. The bees are even and very pretty. As you know, the poor season prevented testing their usefulness.

R. F. Holtermann, Brantford: In conducting this experiment I had one Union queen, and purchased four others, giving me five queens in all. These were introduced to full colonies at various times during July and August, 1894. These were, therefore, entirely, or almost entirely, five-banded bees that went into winter quarters. Four of the queens were Southern, and one was purchased from a Canadian breeder. The report of wintering is as follows: One (No. 3) perished, two (Nos. 1 and 4) came out very weak, having barely two Langstroth combs of bees. When the first brood began to emerge from the comb, one colony (No. 2) was of good average strength covering, which would be equal to six Langstroth frames. The Canadian bred queen (No. 5) wintered well, it was very strong, and when examined was marked XXXX. The two weakest colonies never pulled up, and were not full colonies July 15th, after the surplus honey, which was light, was exhausted.

One of the strongest colonies in the apiary was No. 5, but for some reason it remained without an upper story. This colony gathered sufficiently for its own immediate requirements, and on October 17th weighed thirty-seven pounds, which would probably give at that time about twelve pounds of honey, not sufficient for winter. It never offered to swarm. The queen appeared prolific, but the bees short-lived.

I noticed the five banded bees were among the most active in the apiary. They never missed a chance to rob, and I formed the opinion that they were of such nervous development, that their vitality was quickly exhausted, and the bees were short lived, the energy of the colony being exhausted in keeping up its own strength. When touching the wintering question, one has to be exceedingly careful not to come to quick conclusions, but last winter's reports would tend to show that they are not good winterers.

The season was not a good one, but the fact that they secured no surplus, while others in the apiary secured from eighteen to twenty-two pounds of comb honey, does not speak well for five-banded Italians. The bees were very gentle while the colony was in normal condition, but the two weakest colonies, which, according to my usual practice I requeened were exceedingly cross when queenless. The fact that the two weakest colonies gained strength very slowly, should not be recorded against the five-banded bees, it is likely that the queens suffer as well as the bees in colonies poorly wintered. This if correct would explain such a condition.

Deductions: The five-banded bees appear to be—

1. Below the average as to wintering qualities.

2. Of a high strung temperment, making them short-lived, and therefore poor honey gatherers.

3. Prolific.

4. Gentle, unless queenless, when very cross.

5. Inclined to rob.

W. J. Brown, Chard: The queen I received in September, 1894, was introduced successfully to a moderately strong colony, and was artificially strengthened for fall and winter. The queen layed only a short time before the close of the season. In the spring of 1895 this hive came out weak, and in a short time, in spite of all possible care, dwindled away and died. Her majesty arrived too late to get a fair trial.

John Fixter, Dominion Experimental Farm, Ottawa: In reply to your enquiry about the five-banded queen I would say, I am much pleased with her. The colony to which she belonged gave us seventy-eight sections of honey and two swarms. As to gentleness, I can only say they are good. They appear to be good fighters, and crosser than the black bees. The color is very fine—in fact, the bees are exceedingly handsome. The only fault I have is that we have not enough like this queen.

Wm. Couse, Streetsville: In regard to the five-banded bees and queen, I can say they wintered fairly well, but did not swarm or gather any honey, and had to be fed considerably. I found the bees in several hives in close proximity to their own. They seemed to go into other hives more than any bees I ever handled. They are gentle. The season here was bad, and the bees had to be fed for winter.

F. A. Gemmell, Stratford: The past season has been very unfavorable. I got no swarms, not a pound of honey, and had to feed over $50 worth of granulated sugar syrup for winter. No particular disposition was manifested by the five-banded bees. The first queen was superseded. The queens proved only average layers, and not nearly as good as queens of the Adel or golden Carniolian strain. The bees are fairly gentle. The propensity to rob is not by any means latent, in fact, it is a trifle above normal. They always take a prominent part when an opportunity presents itself. The three-banded or leather-colored queen and her progeny produced bees of a good average strain, but on account of the very unfavorable season I did not get an opportunity of judging of the honey-gathering qualities of either.

C. W. Post, Trenton: As the queen did not arrive until late in the season, I had no chance to test their wintering qualities, and as the season caused almost a total failure in the production of honey, there was not a good chance to test their honey-gathering qualities. The workers, however, showed one good quality, they were the quietest bees that I ever handled requiring no smoke in any kind of weather. Although the queen was a good layer, and plenty of young bees hatched, they never got up to the numerical strength of the leather-colored Italians. I am inclined to think that they are a very short-lived bee. They gave twelve pounds of extracted honey with plenty of winter stores.

A. Pickett, Nassagaweya: As to five-banded bees, my report is not very satisfactory. I could not see any difference in wintering. It was quite easy to handle the bees. We did not get much surplus honey from any one hive, but on the contrary had to feed an average of not less than twenty pounds of sugar to each hive. I could see no difference in the amount gathered. They increase faster than the Italian.

R. H. Smith, St. Thomas: I am sorry I cannot say much about five-banded bees. I received the queen in good order, in May, 1894, and introduced her successfully to a colony that had swarmed, and that lost their young queen. She started to lay at once, and by October there was a larger percentage of her bees to be seen than of any others. They were very gentle and stayed well on the comb, building up to a medium-sized colony by winter. There was no fall flow, so I fed thirty pounds of granulated sugar syrup for winter stores, and packed them in leaves under the same conditions as the rest of the yard. In April when other bees were flying, I found them very weak, and by May they were all dead, leaving plenty of sealed stores. There was no sign of diarrhœa of the bees, or of dampness in the hive. They did not seem to have vitality enough for such a cold winter. All the other colonies in the same clamp wintered well, with only a loss of five per cent.

UNDERDRAINING.

A. W. Campbell, C. E., St. Thomas, Ont.

Horace Greeley, who some years ago passed the remark "Go west, young man," also said that any land worth plowing was worth draining. This with certain limitations I believe to be true. The cost of drainage may exceed the value of the land after it is drained, in which case, or in cases approaching this result, the advisability of drainage is doubtful; or the land may be so perfectly drained by nature that, though the land may be benefited, the additional returns would not justify the expenditure; and it is well to emphasize the fact, that some land which is plowed is not worth plowing and consequently not worth draining. There is no well-defined line of demarcation between soils which can with profit be underdrained and those which cannot; underdraining is not a panacea for all ills, not even the effects of bad farming. But in order to know when it can be profitably applied to farm land it is necessary to look a little into the working of nature.

Soil is porous and, like a sponge, retains in its texture, by attraction, a certain amount of water. When any in excess of this is added, it sinks to the first impenetrable strata or stratas, through which it passes but slowly and from thence rises higher and higher as more is added until it finds a lateral outlet, just as water poured into a pail will rise higher and higher until it finds an outlet in the side of the pail or until it flows over the top. Thus, descending into the ground we come to a certain point where the water is in excess and is stagnant. The most common sources of moisture are rain and snow, but there are other causes of an excess of water in soils which would otherwise have a sufficient outlet, *e.g*, when water is poured out on the surface by springs, or from the high lands. For the germination of plants, there are three requisites—warmth, air and moisture. An excess of moisture in the soil, besides being in itself hurtful to the plant, excludes the other two and prevents proper cultivation of the soil. If the water rises very close to the surface or is swampy, the seed rots in the ground and only aquatic and other wild plants and grasses will grow.

Underdraining supplies the necessary outlet for this excess of moisture at proper depth from the surface. This means, in effect, that the soil is deepened, for the roots will then strike downward and the plant obtains a wider feeding ground, stands more firmly in the earth, and has a greater depth of earth to protect it from the summer drouth. The season is lengthened for growth and cultivation. A strata of ice below the earth's surface melts very slowly in the spring; but when the earth is rendered porous by underdraining, even though the frost may have sunk deeper through the removal of the stagnant water, the melting snow and the warm spring rains quickly pass through the porous earth and it is more quickly warmed and dried for growth or cultivation. That the soil may retain a healthful and proper degree of moisture it must be pulverized as much as possible, and in order to be pulverized it must be moderately dry when plowed, otherwise it is left in hard lumps. Pulverization of soil, besides rendering it more capable of retaining moisture, enables it to absorb the dew and the moisture from the air during the season of drouth. It is the crystallization of stagnant water a short distance below the surface which throws out the roots and results in winter killing. Drained land is lighter to work, is less injured by cattle in feeding, loads may be hauled on it with less injury, and surface washing is prevented. It permits the rain to pass freely through it with its wealth of ammonia, carbonic acid and other fertilizing vapors absorbed from the air. It permits air to reach the roots from which they may obtain their needed supply of oxygen since an excess of water excludes the air. Drainage also warms the soil, as it prevents evaporation and permits the air and warm rain to enter its pores; as heat will not pass downward in water it removes the excess of water which would retard the conduction of the heat downward from the surface of the ground. Underdraining protects the plant from drouth as well as from too much moisture.

When and to what extent underdraining is needed can only be learned by close study of each particular soil and the underlying strata, together with the general geological formation of the district. The depth in a climate where we are subject to severe frosts should not be less than four feet or three at the least, very retentive soils requiring a less depth than those which are porous. Omitting the consideration of frost, the deeper drains are in any case more efficient, for, as will be inferred from my previous remarks on the theory of draining, the greater portion of the water enters the tile from the bottom, not from the top as usually supposed. It is good practice in very porous soils to put a roof of clay directly over the tile to prevent it directly receiving the water. Water entering from the top is very apt to carry sand with it, while it has not been sufficiently filtered of its fertilizing substances. The deeper the drain the fewer drains will be needed. The distance of drains apart must vary with individual circumstances. As has just been said, depth compensates for distance. Some lands need drains ten feet apart, in others sixty feet is not too great a distance. In this the landowner must be guided by his knowledge of the porosity of the soil, the amount of water to be carried off, and the fall which can be given to the drain.

Whatever draining is done should be carried out in a systematic manner. A plan should be drawn showing the location of every drain, together with the general topography of the land. Stones should be placed at the corner of the fields and measurements referred to them. Drains should be, as a rule, laid down in the direction of the greatest fall. The greater one's experience in such matters the more thoroughly they know the impossibility of correctly judging it by the eye, unless the fall is very great. Nor can tile be evenly laid by the method usually adopted, viz, judging the fall by the water level. If a drain is worth putting down it is worth constructing properly. The capacity of a tile drain is limited by the capacity of the bore at its smallest part. If tiles are laid unevenly, hollows act as miniature catch basins for sand and other material which clog the pipe, and to that extent diminishes the whole capacity of the drain above. A drain will work satisfactorily with a fall of 3.20 feet to the mile. Six feet per mile is considered a good fall. The less the fall the greater the danger from obstruction, but with a great fall there is more necessity for careful laying, as at the times of a rush of water the water may force its way through the joints and washouts are apt to occur. In laying tile, care should be taken to make the joints as close as possible. The closest joint that can be made freely admits the water and large openings allow sand to enter the pipe. By revolving the tile or perhaps turning end for end, equal contact all around can be obtained.

In joining one drain with another, some difficulty is experienced. The smaller drain should not meet the main drain at right angles, but should be curved so as to permit the water in it to enter the main drain in the direction of the current. A junction should be made by the use of a branch tile in the shape of a Y, as cutting and fitting tile to one another can rarely be done successfully, the tendency being to cause an obstruction.

Outlets should be as few as possible, and to this end the smaller drains should, if practicable, be carried to one large main drain and thence to a common outlet. The outlet is usually a very much neglected portion of the drain. It should, if possible, be composed of an iron pipe supported by stone masonry. Tile when exposed cannot be safe from frost or the treading of cattle and consequent filling up. It should be protected by an iron grating or screen to prevent frogs, mice and other vermin entering and choking the drain. It is common to see the tile outlet completely submerged in mud, and you need scarcely be told that this is bad practice. The outlet should, if possible, be six inches or a foot above the bottom of the open drain or stream into which it flows.

An important adjunct to tile drains are openings at the junctions or other convenient points where the farmer can frequently ascertain how the drain is working. They should be in the form of catch-basins where sediment coming down the drain may settle and be removed as often as necessary. If these are objectionable in the centre of the field they may be placed at the line of the fences. They should be composed of iron, wood or other

material not easily injured by the frost and should be securely covered. If located in the middle of the field they can be placed at a convenient distance below the surface and covered with earth so as not to interfere with cultivation.

Tile must be hard burned, otherwise they will not stand the frost; they should also be truly circular and straight. In manufacturing they are frequently warped and twisted to such an extent that a close joint cannot be secured. All such should be culled, together with broken tile. The size should not be less than three inches, and this only for very short distances, as tile with so small a bore can scarcely be laid in such a manner as to secure a clear outlet unless the fall is very great.

In deciding upon the size necessary, regard must be had to the amount of water to be carried away, the fall (velocity of the current), and to some extent the distance. A common defect is the presence of lime in the clay, which, when burned and afterwards exposed to moisture, will burst the tile.

In laying tile through quicksand, the best method is to completely surround the tile with sawdust. This at once acts as a sieve, through which sand cannot penetrate, while it allows the water full liberty. In time the sawdust decays, and forms a porous and bark-like covering around the tile. Straw and elm bark are too coarse to act with the same degree of success, and generally prove entirely useless. Slabs laid in the bottom of the trench cause an unequal distribution of pressure, and frequently cause obstructions by broken pipe. In draining swamp land, allowance must be made for shrinkage of the soil, which is composed frequently of vegetable matter in an almost floating condition, so that when the soil has completely subsided, the outlet and drain may be deep enough.

The drainage of stiff clays is a matter which has long been in dispute. Because puddled clay is used so effectually in stopping water in dams, ponds, reservoirs, etc., it is commonly supposed that to drain clay is an impossibility. Clay will absorb more than half its weight and bulk of water, and "puddling" is merely the working, treading or stirring of wet clay until it is thoroughly saturated, and its particles so firmly divided that water has an exceedingly slow passage between them. We see the effect of this on roads in the ruts; and in the fields where cattle have been treading water remains in the footprints long after the surface of the ground elsewhere is dry. After the water has been removed from the puddled surface of the clay by evaporation, it will be observed to crack under the hot rays of the sun. Clay shrinks nearly one-fifth of its bulk by drying, and as the sides cannot approach each other, it is torn apart in different directions. Everyone who has observed the bottom of a ditch or drain in clay land, must have seen this phenomenon on a larger scale, the whole soil being divided into a network of fissures. If any of you have tile drains through clay lands, you will observe in the season of drouth deep cracks in the surface of the ground over the drain and extending down a considerable distance. If you could see into the ground, you would observe these fissures extending in every direction from the tile; from the main fissures smaller ones extend, until the whole subsoil is a network of fissures, which are in effect miniature underdrains. Just as the sun drew the water from the surface of the puddled soil, causing it to contract, so has the tile drain taken the water from the soil in immediate contact with it, until it is contracted and cracked, and the fissures thus formed became new drains to lead the moisture to the tile, and so the process of shrinking and cracking goes on until the stiffest clay soil is thoroughly drained. In time, vegetable and other fertilizing matter is washed into these cracks, and after a few years of thorough cultivation no more productive soil can be obtained.

The life of a tile drain varies with circumstances, but should be at least half a century if carefully laid. To take up tile, clean and relay them is generally a more expensive operation than constructing a new drain, and no pains should be spared in avoiding this contingency.

By the use of tile drains, the necessity of open drains is avoided. Beside the loss of a large amount of land occupied by the open drain, and a space on each side

which there is not enough room to cultivate, the presence of open drains results in much inconvenience to the farmer in his farming operations. Time is wasted in seed time, and in harvest in turning the plow and harrow, the reaper and the horse-rake, and hand labor must be employed to work on the banks. True economy requires a liberal expenditure of labor and money in securing tile drains wherever drainage is necessary.

T. G. Raynor, Rose Hall: If by saying ditto to what Mr. Campbell has given us in his valuable paper, I would sufficiently emphasize it, I should feel that I had said enough. I quite agree with Mr. Campbell on the principles he has laid down for draining. There should be a thorough developed plan of drains laid out on paper, with a good outlet. Provision should be made for silt basins where required, and for the use of round tile, which should be carefully laid. The depth should be three feet when possible, and the distance apart should suit the kind of soil drained. As a rule, the more tenacious the clay the closer should be the drains, etc. I agree with him also in the very many benefits arising from a thorough system of underdraining. It causes the land to be worked earlier in the spring, and also after heavy rains; it increases the productiveness of the soil; it allows better distribution of the manure, and it increases the advantages from the atmosphere while passing through the soil, etc. Just here allow me to remind you of the contrast between the processes of filtration as compared with absorption, or underdraining as compared to surface flow and evaporation. We know that absorption is a cooling process, requiring heat. Much more heat is required to evaporate water than to raise it to the boiling point. In swampy lands which have been underdrained, a difference of several degrees of temperature has been noticed. Perhaps I could not better summarize the benefits from underdraining than by saying that all the benefits arising from a thorough tillage are greatly augmented by the soil being underdrained. Plants are enabled to obtain food at a much greater depth. There are but few farmers in this rolling Province who have not fields which "hang out their signals of distress," and which would be greatly benefited by underdraining. I think that lack of drainage is one of the greatest leaks upon our farms. Perhaps only second in this respect is our general method of handling farmyard manure. I believe that where a farmer has a limited amount of capital, at least a partial system of underdraining is the proper thing By the placing of the drains where they are most needed, as in the lowest portions of the fields, with an eye to future completeness, the system can be extended at any time, as a person's capital accumulates. By using a plow, a foot or so of the ground may be loosened in such a way that it may be easily turned out with a shovel, and in this way the cost of digging may be materially reduced as compared with doing all the work by hand. In my opinion water is the best leveller, and if we dig at a time when there is a proper amount of water in the soil, there is little or no trouble in securing the proper grade. If the soil is heavy, sods may be carefully placed over the tile. These, with a few inches of earth thoroughly tramped down, will make a very good covering. In conclusion, I would say that I believe it pays to underdrain.

Q. What length of time will a tile drain stand?

Mr. Campbell: Probably fifty years. It will depend on the drain, where and how laid.

Q. Will tile rot?

Mr. Campbell: No, not if made of the proper material. If the material used in making the tile is all right before made into tile, and then properly laid so as to prevent it from crystallizing.

Q. Would you recommend using a glass?

Mr. Campbell: I do not know that using a glass is of any particular use.

Q. Would you recommend using straw?

Mr. Campbell: No.

Q. Is it possible that a certain kind of soil will not underdrain, where it is difficult to get sufficient fall in the drain? I understand that such has been the case in draining in some sections.

Mr. CAMPBELL: What kind of clay?

A. Blue clay.

Mr. CAMPBELL: I find nowhere in Ontario where underdraining has been a greater benefit than to the western part of this Province. They lay the tile properly, and no difficulty has been experienced in layeng tile in stiff clay soil.

Q. If the fall is sufficient?

Mr. CAMPBELL: Yes.

Q. Do any of you use coarse stone or gravel. I heard of some filling their drains with straw on top of the tile. They had to take that all up and put in coarse stone and gravel, which I think will keep the tile to its place better than straw or any of those things. If any of you have tried gravel let me hear of it.

Q. Would you recommend putting in gravel?

MEMBER: I put in coarse stone.

Mr. KEIL: I would like to ask this gentleman if he did not have any gravel, what would he do.

A. I would not put any in.

Mr. CAMPBELL: In our section of the country we have drains that are very level, and it is quite usual for men to do their own levelling. It is not necessary for a man to get an engineer. Level with your own instrument. Simply take a spirit level, which is certainly level, and place it on a board. You can go through your field and do practically good work with this instrument, in ordinary farm work.

Q. I would like Mr. Campbell to give us any information he can, in regard to sandy bottom land.

Mr. CAMPBELL: This would require some little time to answer properly. Relieve the land of the surface water; allow the ground to settle; keep your tile as much as possible on hard bottom; and make the grades all long, and uniform as possible. Keep all these things in view. Make your drains as long as possible, then uniform from point to point.

ADDRESS.

BY DR. MYERS, DIRECTOR AGRICULTURAL EXPERIMENT STATION, MORGANTOWN, WEST VIRGINIA.

It is with a great deal of pleasure that I am able to be here to-day and see you assembled in your council hall to discuss the importance of advancing the great agricultural interests of Ontario.

I do not know when it has been my pleasure to visit an institution that offers greater advantages for the education of young men for the great activities of life than are offered at this College. I cannot well see how a young man could go through this institution, taking its course of instruction, and coming in contact with the distinguished men who preside over it and control airs, without going away to be useful and progressive citizens in this great country.

It is comparatively a few years since it was thought necessary to educate the farmer. I can remember, and I presume the older gentlemen here on the floor remember very dictinctly, when it was quite fashionable to practice medicine without any training;

preachers could preach without preparation, lawyers could carry on practice of law without any preparation ; but, it has dawned upon our progressive citizens that it is not only necessary to teach the lawyers and doctors, but also the farmers, the theologians, and the farmers' boys.

I am pleased to state that this institution has extended its reputation all over the northern part of our country. We know more about you gentlemen, perhaps, than you think we do. We are quite a piece away, but we know something of you, as may be shown by our sending here every now and then and taking away some of you. (Applause). Over in the country that I came from, we are on the lookout for bright young men who have fitted themselves for doing something in life. We do not want those all-round fellows, but young men who are prepared to do something well. We would just as leave come to the Agricultural College at Guelph, or anywhere else to get them. We do it. (Applause).

Now we want every young man here to feel that he is enjoying many opportunities, and that the world expects a great deal of him ; that there is an ample field in which to exercise his ability. Now, you can go a long distance, and you will not find better opportunities than President Mills and his faculty have for you here. I have seen some stakes out around here, that look like some stakes down in our country. I believe there is most excellent work being done with those stakes. At your institution these stakes are under the superintendence of Mr. Zavitz, and let me tell you they mean something. You want to keep a lookout for them. There is something there. There is liable to be more, so keep a sharp lookout on those stakes. We have stakes of that kind in our country. They mean something there also. There are stakes of that kind being driven all over this country of yours. You have skilled men, I understand, to the number of probably fifteen hundred or two thousand driving stakes all over this Province. They mean something there. What do they mean? They mean that the influence of this College is being felt, that agriculture is being elevated, and that in the future the agriculture of Ontario, and the agriculture of the States will be placed upon scientific principles.

REPORT OF COMMITTEE ON THE CONSTITUT ON.

The committee on the revision of the constitution beg leave to report as follows :

Constitution.

Articles 1 and 2—To remain the same.

" 3—Change membership fee from 50 to $1.00 and strike out " Commissioner or."

" 4—Change to read "The officers of this Association shall consist of a President, Vice-President, Secretary, and Treasurer, five directors and two auditors, who shall hold office for one year or until their successors are elected."

Articles, 6, 7 and 8—Strike out.

By-Laws.

Articles, 1, 8, 9, 11 and 13—Strike out.

" 2, 3, 4, 7, 10 and 12—To remain.

Article, 5—Leave out from " Executive " to " Council " and add instead " Board of Directors."

Article, 6—After the word " Editor " add " to be appointed by the Board of Directors."

Also leave duties of experimental committees the same as at the present time.

The report was passed by the meeting.

THE FOOD VALUE OF MILK AND ITS DERIVATIVES; COOKING OF MILK, CHEESE AND EGGS.

Miss Bessie Livingston, Supt. Ottawa School of Cookery.

In arranging this address for the meetings of the Farmers' Institutes, I did not expect be called upon to speak before such representative audiences as have attended the meetings in Guelph, and it is with a feeling of timidity that I venture to speak of the food value of milk, butter and cheese to an audience, many of whom have investigated and treated the subject much more exhaustively and scientifically than I have.

However, I may present the subject in a somewhat different manner than that to which you have been accustomed to think of it, and also suggest new ideas in the combination and preparation of some of the most common foods which we get in almost perfect condition from the farm, and from which a great number of nutritious and appetizing dishes can be made.

The food value of any article of diet depends largely upon the amount of nutritive and digestible matter it contains, and upon how far it may meet the different requirements in the various offices which food performs in the body. We require food to build and repair the tissues and fluids of the body, and also to furnish heat and energy. Our bodies being varied in structure, we require foods of varied character to nourish the different parts. We are accustomed to speak of milk as a typical or perfect food because it contains in correct proportion all the elements necessary for the nutrition and development of child life.

Composition of Milk. The composition and quality of milk are influenced by race, feeding, etc., etc., but a fair average analysis of milk shows that it contains about eighty-seven per cent. water and thirteen per cent. solids, the solids consisting of mineral matter, casein or curd of milk, fat and milk-sugar. These different constituents serve different purposes in nutrition. The mineral matter furnishes material for the teeth, hair and bony structure; the casein or curd is the flesh or muscle-forming and stimulating food; the fat rounds out the muscles and serves as a fuel and heat-producing agent; the sugar of milk furnishes muscularenergy and heat. The large proportion of water acts as a solvent agent upon other foods and floats them through the body. Perhaps these latter statements have been somewhat positive, as it is supposed that one constituent may perform to a certain extent the offices of another, yet the best authorities agree in considering that the best results are obtained from a correct combination of them all. During early life, milk should form an important part of a child's diet, and when nature has provided a food so simple, complete, and easily digested, we should infer from this that simple feeding should be continued up to the age of at least six or seven years. Much of the irritibility, debility and lack of power to resist disease in children is due to improper feeding. Stronger foods are given than the immature organism can assimilate, and when we consider the ill effect of undigested food upon the adult, how much more disastrous it must prove to the delicate organism of childhood. In later life the effects are seen in the defective dentition and many other prevalent physical defects.

Milk served with bread, potatoes, rice and other grains is well suited to the nourishment of adults. A diet of milk alone is frequently prescribed in fevers and other diseases where the digestive organs are weakened, and it has been suggested that it might prove a valuable food in old age, to remedy the defective tissue formation of that period.

We cook our foods in order to improve their taste, develop new flavours, and also to make them easier of digestion. We are not accustomed to think it necessary to cook food which is furnished us from nature's laboratory in such assimilable form as milk, but in some cases it is necessary. A glass of hot milk furnishes a pleasant stimulant to many who find that cold milk disagrees with them. The flavour also is improved by cooking for instance, the flavour of cooked milk in coffee is more agreeable than uncooked.

Milk forms a particularly suitable medium for the growth of the little living organisms (bacteria) which are so frequently the source of infection and disease. No dangerous organism is said to be present in the milk drawn from a healthy cow, the contamination coming from some surrounding source, either during or after the process of milking, hence the necessity of absolute cleanliness in its care. In large cities where the source of milk supply is unknown, the precaution is frequently taken to scald the milk, or can it, as we do fruit; it would be wise to adopt this plan where any doubt exists as to the purity of the milk. Sterilized milk is now commonly prescribed in the diet of young children. The milk is put in clean bottles or fruit jars, which are corked with baked cotton, and placed in a pan or pail of warm water. The water is raised to a temperature of about 190° and allowed to stand at that temperature for an hour. The bottles are then removed and cooled as quickly as possible. Enough for one feeding only is sterilized in each bottle. By this method the milk does not reach the boiling point, and the physical condition of the milk remains unchanged. By some authorities boiled milk is considered to be indigestible.

In this pan I have one pint of milk. It is heating over boiling water. Were I to place the pan of milk directly over the fire to heat, we would probably find that it would have been burned at the side of the kettle, and a disagreeable flavour would have resulted. Were it left a little longer it would boil over. This is probably due to the fat and sugar in the milk, for we know the tendency of fats and syrups to boil over. When heated over hot water, milk will not boil. It will reach a temperature of about 196°. The boiling point of milk is a few degrees over 212°. From this pint of milk I shall make a soup, the proportion of materials used being one pint of milk, one cup of mashed potatoes, and one scant tablespoonful each of flour and butter. Melt the butter, then add the flour and cook it thoroughly. In this we have a lesson in cooking starch. Starch is a most important food in its relation to the production of heat and force, and its value as food depends upon its being properly cooked. Starch is a glistening white powder made up of little sacs or grains which require much heat to break them up. The butter reaches a degree of heat about one hundred times greater than milk or water, and the starch is thoroughly cooked in three or four minutes. If I were cooking this starch in milk or water, it would be necessary to cook it fifteen or twenty minutes. To this flour and butter I shall add the hot milk, stir until smooth, then add the potato. I could have used the same quantity of any strained vegetable, peas, tomato, carrot or celery. Milk being deficient in starch, the addition of the potato gives a better balanced dish. To this soup I shall add for flavor and garnish, a tablespoonful of grated cheese and a little minced parsley. In this soup we have a nourishing, appetizing food and one which might be served as a hot supper or luncheon dish very acceptably in cold weather.

Fat. Fat is one of the most important food products, and we get it in a very agreeable and digestible form, in the cream or butter of milk. Animal fats undergo certain chemical changes in the process of cooking, which makes them unwholesome. Vegetable fats, such as olive oil, etc., are more wholesome for cooking purposes.

Cheese. When we come to consider the food value of cheese we have to deal with milk in its most concentrated form, as in the process of cheese-making the water is removed, the casein coagulated by the rennet, and then subjected to pressure which makes it a close and compact food. Cheese, if eaten raw, is generally regarded as being difficult of digestion. I am going to cook a savory and nutritious cheese-dish from one cup of grated cheese, one-quarter cup of milk, one teaspoonful of butter, one egg, pepper and salt to taste, and four slices of bread. I shall put the milk and cheese in a pan, place over hot water and cook until the cheese is melted. Then add the butter and the beaten egg, the pepper and the salt, and cook two or three minutes, or until it thickens.

This we might call a cheese custard. The bread has been soaking in one cup of milk to which was added a beaten egg. I shall fry it in butter, a delicate brown, and pour the cheese custard over it.

The addition of milk to the cheese brings it back nearer to its original condition. The addition of the bread makes a well-balanced food, and cooking renders it more digest-

able. Very often when we eat cheese we do not consider its very highly nitrogenous character, as one pound of cheese is equal in nutritive value to nearly two and a half pounds of beef, and as a matter of economy and variety, we should substitute a cheese-dish for meat occasionally, instead of serving it with meat or other nitrogenous foods.

Cooking of Eggs. Eggs, like milk, form another complete food and like the milk and cheese, being a food that can be eaten raw, required little cooking. They form a very nutritious and concentrated article of diet, and it is well to combine them with milk or other liquid and starchy foods such as bread, potatoes, rice, etc.

The most important point to be observed in cooking eggs, is that the temperature does not exceed 160° or 170°, which is considerably below the boiling point (212°). When cooked at a temperature of 160° or 170° the egg is tender and delicate, when raised to 212° it becomes tough, hard and indigestible. There are two ways by which an egg is properly cooked in the shell. Put enough boiling water in a saucepan to more than cover the eggs to be cooked, let them stand on the hearth or any place where the water will not cool too quickly and in ten minutes the egg will be cooked soft, or put the eggs into cold water and bring them slowly to a boil. In order to cook the eggs hard to the centre, they need only to be exposed to a continued heat in hot water for half an hour. In order to properly cook eggs, milk, meat and other albuminous food, the knowledge of the proper temperature is necessary, and we should apply this principle in the cooking of any custard or puddings, where eggs are used. In preparing an egg and milk dish where starch is used, the starch should be thoroughly cooked first.

I shall make an omelet to illustrate the cooking of eggs. I shall beat two eggs just enough to mix the yolk and white together, then add two tablespoonsful of water. Milk might have been used instead of water but its cheesy property has a tendency to toughen the omelet. Pour it into this small frypan in which one-half a teaspoonful of butter has been melted. Cook it slowly. As the under part of the omelet begins to cook, prick it with a fork to let the uncooked part pass under. When cooked to a soft creamy consistency sprinkle with salt and pepper. I shall also sprinkle one tablespoonful of grated cheese over it, roll and turn as usual.

A variety of omelets may be made, the difference depending upon the ingredient, which is added last. Instead of cheese I might have used grated ham, parsley, oysters, tomatoes, etc., etc.

REPORT OF COMMITTEE ON ECONOMIC BOTANY AND ENTOMOLOGY.

Prof. J. H. Panton, Agricultural College, Guelph.

The committee appointed to collect information concerning the presence of injurious insects, fungi and weeds throughout the Province of Ontario issued 250 circulars of enquiry to the secretaries and some others of the Union.

The replies received come from the following thirty-eight counties: Renfrew, Lanark, Addington, Lennox, Hastings, Russell, Prince Edward, Waterloo, Perth, Lambton, Peel, Grey, Wellington, Huron, Brant, Middlesex, Oxford, Dufferin, Bruce, Victoria, Ontario, Dundas, Welland, Haldimand, Glengarry, Norfolk, Lincoln, Simcoe, York, Essex, Carleton, Wentworth, Northumberland Kent, Muskoka and Manitoulin.

In 1894 we were able to obtain replies from only twenty-four counties, while this year we have obtained them from thirty-eight, consequently our information is derived from a much more extensive area. The accompanying blank form shows the kind of information sought, and, if it is properly filled, supplies very valuable notes upon weeds and insects.

ECONOMIC BOTANY AND ENTOMOLOGY.

DEAR SIR,—You will confer a great favor by filling out the following and sending it at as *early a dat as possible*. I shall take pleasure in identifying plants or insects forwarded at any time to the College Information in reference to columns four and five is particularly requested. If you have applied an remedies for injuries from insects, mildews, etc., GIVE YOUR RESULTS

J. HOYES PANTON.

1. Names of six most common weeds in your district.	2. The six worst mildews, blights, smuts, rusts, etc.	3. The six worst insects.	4. Any new weeds or blights likely to be injurious.	5. Any new insects likely to be injurious.	6. Any plants considered poisonous.

REMARKS.—

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The following is a summary of the replies received :

1. The worst weeds reported.

Canadian Thistle (Cnicus arvensis).
Mustard (Brassica Sinapistrum).
Ox-eye Daisy (Leucanthemum vulgare).
Wild Oat (Avena fatua).
Ragweed (Ambrosia artemisiæfolia).
Couch grass (Agropyrum repens).
Burdock (Arctium Lappa).

Forty species of weeds are referred to, but the above seven are those which have been mentioned by fourteen or more observers.

2. New weeds and blights reported as likely to be injurious.

Perennial Sow Thistle (Sonchus arvensis).
Bindweed (Convolvulus arvensis).
Prickly Solanum (Solanum rostratum .
Prickly Lettuce (Lactuca scariola).
Plum Rot (Monilia fructigena).
Anthracnose of Raspberry (Gloeosporium venetum).
Rib Grass (Plantago lanceolata).
Penny Cress (Thlaspi arvense).

3. Worst fungi reported.

Rust (Puccinia graminis).
Smut (loose), (Ustilago Carbo).
Apple "Spot" (Fusicladium dendriticum).
Black Knot (Plowrightia morbosa).
Corn Smut (Ustilago maydis).
Wheat Smut (Tilletia fœtens).
Peach Curl (Taphrina deformans).
Anthracnose of the Raspberry (Gloeosporium venetum).
Potato Blight (Macrosporium Solani).
Gooseberry Mildew (Sphærotheca mors-uvœ).
Grape Mildew (Peronospora vitisola).

4. The worst insects reported.

Potato Bug (Doryphora decem-lineata).
Horn-fly (Hæmotobia serrata).
Grasshopper (Melanoplus femur-rubrum).
Curculio (Conotrachelus nenuphar).
Codling Moth (Carpocapsa pomonella).
Turnip-fly (Phyllotreta vittata).
Pea Weevil (Bruchus pisi).
Cabbage Worm (Pieris rapæ).

Besides the above, thirty additional species were reported, but only by a few observers.

5. New insects reported likely to be injurious.

Aphis on turnips, oats and peach leaves.
Plum Scale (Lecanium).
Peach Borer (Sannina exitiosa).
Blister Beetle (Epicanta Pennsylvanica).
Buffalo Carpet-beetle (Anthrenus scrophulariæ).
Grape-vine Flea-beetle (Graptodera chalybea).
Pea Bug (Bruchus pisi).

Poisonous plants.

Nightshade (Solanum nigrum).
Poison ivy (Rhus toxicodendron).
Poison sumac (Rhus venenata).
Wild parsnip (Pastinaca sativa).

Spraying. Comparatively few reports stated that spraying was done to any extent; but when tried it proved successful. The references to blanks for the names of new weeds and blights, for any plants considered as poisonous, and for any new insects likely to prove injurious, were not so well filled as we would like to have seen them. It is very important to note the arrival of new pests, for if looked after early in their appearance, it is often possible to prevent them ever getting a foothold. The worst insects, mildews and weeds were well reported upon.

In the column for new weeds and blights likely to prove injurious, though many species were mentioned, very few were referred to by more than one observer. The committee are particularly desirous that experimenters give this group particular attention next year, so that better information may be secured regarding the distribution of some new forms. They also express a desire to have special attention given to the column for new insects, so as to obtain more data regarding such species as the Turnip Aphis, Buffalo Carpet-beetle and Blister-beetles.

The committee thank the observers for the information which they have given, and hope they will continue to take an interest in this work. The Professor of Biology at the College will always take pleasure in determining the species of plants or insects referred to him. We would recommend observers in their returns to mention any remedies which they have found successful against insect and plant pests referred to.

Committee, { F. C. Harrison
L. W. Lang.
J. Hoyes Panton, Director.

CO-OPERATIVE EXPERIMENTS IN AGRICULTURE.

C. A. Zavitz, B.S.A., Agricultural College, Guelph, Director of Co-Operative Experiments in Agriculture.

As director of the committee of co-operative experiments on agriculture, I am again asked to present the report of the work carried on throughout Ontario. Some of you in this room may perhaps remember that ten years ago it was decided at a meeting of this kind that some co-operative experimental work should be conducted in connection with our Experimental Union, and a small committee was appointed at that time to establish work of this nature throughout Ontario. I believe that the speaker is the only member of that committee who is still working in connection with this co-operative work. Prof. James, who is now Deputy Minister of Agriculture for Ontario, and Mr. F. J. Sleightholm, who has had charge of the travelling dairy during the past season, were both members of the first committee on co-operative experimental work on agriculture in connection with our Union. During the first five years, the committees appointed were able to make but little headway in connection with this work; but during the past five years the work has made a very steady and substantial increase, and at present occupies a very prominent place in the agriculture of this Province. In 1886 there were but 12 experimenters, and during the past year upwards of 1,700 were engaged in this work, which is an increase of over one hundred-fold in the ten years.

The year 1895 has been rather a severe one in connection with our experimental work, owing to the severe frosts which we had during the month of May, and the exceeding dry weather which occurred during the growing season. There have been a good many failures reported. I am pleased to state, however, that we are enabled to present to you a larger number of successfully conducted experiments than during any of the previous years. A number of the experimenters speak of failures caused, not only by the effects of frosts and drouth, but also through the ravages of grasshoppers and poultry and also through accident.

I wish to draw your attention for a short time to the increase of the co-operative experiments during the past ten years by referring you to the chart which you here see upon the wall. In the first column is mentioned the years during which our experimental work has been conducted; the second column gives the number of distinct experiments during each of the ten years; the third column gives the number of experimenters over Ontario, who were successful with their experiment and who sent us carefully prepared reports of their year's work; and the last column gives the number of plots used for the successfully conducted experiments during each of the years mentioned.

Co-Operative Experiments in Agriculture.

Successful experiments for ten years.

Years.	Experiments.	Successful experimenters.	No. of plots.
1886	1	8	33
1887	1	27	135
1888	1	40	240
1889	4	21	76
1890	6	21	64
1891	12	126	662
1892	12	295	1,585
1893	13	416	2,105
1894	14	504	2,520
1895	15	513	2,356

It will be observed from the foregoing table that co-operative experimental work in agriculture has had a very substantial growth in different respects. It will be remembered hat this table does not represent the full number of those who undertook experimental work, but simply those who were successful and whose reports are used in the summary

to be given here at this time. There were in all upwards of nine thousand packages of grains and fertilizers sent over Ontario in connection with this work during the past season. Tests were undertaken upon upwards of seven hundred different farms distributed throughout this Province. You will see by this that the number is sufficient to reach nearly all the neighborhoods. We have sent a fair amount of experimental material to the northern sections of Ontario, especially in Parry Sound, Muskoka and Algoma; in fact the distribution has been fairly uniform throughout the Province as far north as Algoma. The material for experimental work is first sent to the members of the Union, and then to others throughout Ontario who desire to carry on co-operative experimental work. I wish to have it clearly understood, however, that we do not send out the experimental seeds, grain or fertilizers to any person who has not sent in an application for them. The demand is increasing year by year, and during the past three or four seasons we have been unable to supply the full number of applicants with the desired material owing to the demand being so great.

The system of our co-operative work is now established in such a way that we are very careful not to change it in any way unless we can see a direct advantage therefrom. By so doing we are enabled in many instances, not only to present the report of the year's work, but also in addition to give the average results of the same experiment for two, three, four, or even five years in succession. Great care is exercised in using none but carefully prepared reports of successfully conducted experiments for our reports. For instance, if any experimenter receives six varieties of oats for his tests, and should, through any cause whatever, neglect to report upon any one of the varieties, his report would be put aside and not used by us in any instance. The force of this can be seen when you consider that the yield of the five varieties would quite likely be greater or less than the average of all the reports, and consequently would make the average higher or lower for the five varieties included in this particular experiment, while the average of the variety not reported upon would remain constant. Several questions are asked each experimenter, and if the experiment is unreliable in any way as made manifest by the answers given or the report received, the results are not included among those used for the summary.

The cost of our co-operative experiments in agriculture during the past year has been $537, which amount has been used for the material and manufacture of about ten thousand bags in which to send out the experimental seeds, printing, postage and expressage. It will be plainly seen that these are items that cannot be cut down to any marked degree. If the work is increased to any perceptible degree, more money will be required to be expended in 1896 than was used in 1895.

Importance of the Co-Operative Experiments in Agriculture Throughout Ontario.

During the first few years' work of the Union, the experiments were confined entirely to the testing of fertilizers, but during the past season fertilizer experiments numbered but two among a total of fifteen. The experimental work now covers nearly all kinds of farm crops in Ontario. The following table gives the number of acres devoted to the various farm crops throughout Ontario during the present year. We have one or more experiments conducted with each of the farm crops which are mentioned. There is no reason why our co-operative experimental work should not have an influence upon each and all of these crops.

Field Crops in Ontario, 1895.

	Acres.
Hay and Clover	2,537,674
Oats	2,373,309
Peas	799,963
Fall wheat	743,199
Barley	478,046
Corn	452,828
Spring wheat	223,957
Potatoes	184,647
Turnips	151,805
Mangels	34,383
Carrots	13,002

It might be interesting if you would make a calculation for yourselves as to the influence of this co-operative work, providing the Experimental Union, though its co-operative experiments, would increase the average yield of each kind of grain over Ontario one bushel per acre. For instance, if the yield of oats were increased one bushel per acre for one year, it would increase the amount of oats in Ontario over two and a quarter million bushels. This slight increase, valued at twenty-five cents per bushel, would be worth over $500,000. I will allow you to make the calculations respecting the other crops for yourselves.

The following circular was sent out in February to members of the Union, to previous experimenters, and to those who applied to the College for seed:

DEAR SIR,—The members of the Ontario Agricultural and Experimental Union, along with other interested farmers over Ontario, are carrying out a system of co-operative experiments in agriculture. This work was started upon its present plan in the spring of 1886 with twelve experimenters, who received the grains and fertilizers, carried out the necessary instructions, and reported the results at the end of the season. For the first two or three years the experiments were confined almost entirely to the ex-students of the Agricultural College, but as many other farmers expressed a desire to join in the work the invitation was extended to them also, and material was sent to those who applied on the condition that they would be careful to follow the necessary instructions and report the results of their tests after harvest. The work has steadily increased since its commencement, and during the past three years the Union has been unable to supply the material to the full number of applicants, owing to the demand being so great. In 1891 there were 2,642 plots, in 1892, 5,688 plots, in 1893, 7,181 plots, and in 1894 upwards of 7,700 plots were used for these co-operative tests over Ontario. Reports of successful and valuable experiments were received during the past year from every county in Ontario.

The members of the committee on agricultural experiments are pleased to state that for 1895 they are again prepared to distribute into every township of Ontario material for experiments with fertilizers, fodder crops, roots and grains. Upwards of 800 varieties of farm crops have been tested at the Experiment Station, Guelph, during the past six years. These consist of nearly all the Canadian sorts, and about four hundred new varieties imported during the past eight years from different parts of Europe, Asia, Africa, Australia and the United States. Some of the kinds have done exceedingly well and are now being distributed over Ontario in small quantities. Great care is exercised in sending out real choice varieties.

Prosperous farmers do not find very great difficulty in conducting these experiments successfully, but care certainly needs to be exercised in every instance, and when this is done the experimenters are far more than repaid for all the time and labor expended. Each experimenter gleans information from his own work and also has the benefit of the report of similar experiments from other parts of Ontario. The results of carefully conducted experiments are presented in a summary form to the annual meeting of the Union, held in December, at the Agricultural College, Guelph, and are afterwards printed more fully, along with the proceedings of the meeting, as an appendix to the report of the College. Each experimenter is invited to this annual gathering of the Union and also has forwarded to his address a copy of the report.

Each person who wishes to join in the work may choose any one of the experiments for 1895, fill out the accompanying form of application and return the same to the Director of the Co-operative Experiments in Agriculture at as early a date as possible. The material will be furnished in the order in which the applications are received until the limited supply becomes exhausted. A sheet containing the instructions for conducting the various tests, and the blank forms on which to report the results of the work, will be sent to each experimenter at the time the fertilizers or seeds are forwarded. All material will be furnished entirely free of charge to each applicant, and the produce of the plots will, of course, become the property of those who conduct the experiment. In return, *the Committee desires to ask that each experimenter will sow all the plots belonging to the particular experiment which he has chosen for 1895, and that he will be very careful and accurate in his work, and forward to the Director by October 25th, 1895, a complete report of the results obtained from the tests.*

Yours truly,

C. A. ZAVITZ,

Director Co-operative Experiments in Agriculture.

A blank form upon which each person, desirous of conducting an experiment, could make his application, was sent with each of the above circulars. A list of experiments to be conducted during the year was also enclosed from which each person could choose as he desired, mentioning his choice upon the form sent.

As soon as each application was received it was entered upon our books, and the experimental material was sent out in the order that the applications were received. The demand was very large, but in nearly all instances we were enabled to supply the full number of applicants. Besides the experiments mentioned in the above list, it was arranged later in the season that an experiment would also be carried on, in testing six leading varieties of potatoes, and in the autumn an experiment was arranged for testing leading varieties of winter wheat. The applications for both of these were very numer-

ous' and in the case of the last-mentioned experiment, we were not able to supply more than seventy-five per cent. of the applicants with the desired material; we, however, sent out upwards of 3,000 packages of winter wheat.

The following is a list of the experiments and of the blank form sent out:

No. of Experiments.	Name of Experiments.	No. of plots Required for each.	Size and shape of each plot.
1.	Testing nitrate of soda, superphosphate, muriate of potash, mixture, and no manure with oats	5	2 rods x 1 rod
2.	Comparing the advantage of nitrate of soda over no fertilizer with rape	2	2 rods x 1 rod
3.	Ascertaining the relative value of four varieties of millet	4	2 rods x 1 rod
4.	Growing lucrene as s crop for green folder	1	4 rods x 4 rods
5.	Growing crimson clover as a crop for hay	1	4 rods x 4 rods
6.	Testing six leading varieties of folder corn	6	1 rod x 1 rod
7.	Testing five leading varieties of turnips	5	1 rod x 1 rod
8.	Testing five leading varieties of mangels	5	1 rod x 1 rod
9.	Testing five leading varieties of carrots	5	1 rod x 1 rod
10.	Testing five leading varieties of spring wheat	5	1 rod x 1 rod
11.	Testing six leading varieties of barley	5	1 rod x 1 rod
12.	Testing five leading varieties of oats	6	1 rod x 1 rod
13.	Testing four leading varieties of peas	4	1 rod x 1 rod

Material for No. 1 experiment will be sent by express, and for each of the others it will be forwarded by mail. All fertilizers and seeds will be sent in good time for spring seeding, providing the applications are received at an early date. The supply of material being limited, those who apply first will be surest of obtaining the desired outfit. It might be well for each applicant to make a second choice for fear the first could not be granted. The experiments selected should be indicated by using the numbers shown in the left hand column of the table given above.

Particular varieties need not be mentioned as all the kinds to be distributed are those which have done exceptionally well upon the trial plots at the Experiment Station.

This Form of Application.

Experiment chosen (*indicate by number.*) { 1st choice..... 2nd choice.....

Name.....Line of railway .....

Post Office.....Township.....

Express Office.....County.....

The following letter was sent with each set of experimental material:

Dear Sir,—Your application for material for experimental work has been received, and we have entered your name upon our books as one of the experimenters for 1895. If you have asked for No. 1 experiment, the material is now being forwarded to your express office; but if your application calls for any of the other experiments, the material is herewith forwarded to you by mail.

For each experiment, soil of a uniform character throughout should be selected, and the plots should be so located that there would be no danger of trespassing by poultry, etc. The preparation of the land should be similar to that for the same kind of crops in larger fields. Be sure and sow every package of seeds or fertilizers which you receive, or the value of the experiment will be greatly impaired. If you are not familiar with any of the varieties in the experiment, it would be a good plan to sow an extra plot with some variety which you have grown for several years and with which you could compare the new kinds.

We are sending out some of the best varieties of farm crops, selected from all the kinds obtained in Ontario or imported from foreign countries and tested in the experimental department of the Agricultural College, Guelph, for several years in succession. Each test is worthy the careful attention of the experimenter. We hope that you may have much success with your experimental work during 1895, and that we will get a good report from you before the 25th of next October.

Yours very truly,

C. A. Zavitz

Director of Co-operative Experiments in Agriculture.

The greatest advantage of this co-operative work is perhaps derived by the experimenters themselves, who tested these different varieties, or different fertilizers upon their own farms, but the summary results also possess much useful information. This co-operative experimental work corroborates the experimental work carried on at the Agricultural College, and this, when combined with these experiments at the College, makes the results much more reliable. It is very pleasing to notice that there is a great uniformity in the results of the Union work during the last four years when one year is compared with another. There is also a great similarity in the results of the different varieties tested over Ontario in comparison with the same varieties tested in the experimental department of the College. The following gives the instructions, individual results, summary results, and the conclusions of each of the experiments in agriculture carried on during 1895:

I. FOUR FERTILIZERS AND NO FERTILIZER WITH OATS.

(1) Upon uniform land, which has received no manure for at least four years, mark off five plots of one-eightieth of an acre each, leaving a clean path, three feet wide, between the plots. Two rods long by one rod wide is the size recommended for each plot.

(2) Treat all plots alike as regards cultivation of ground, etc., and sow the packages of Siberian Oats upon the five plots, as indicated by the labels on the bags. Aim at seeding one inch deep, and cover the seed by going crosswise over the plots with a light harrow, or by using a hand rake.

(3) Apply the fertilizers upon their respective plots, as indicated by the labels on the bags.

(4) When the plants are three or four inches high, cut off all those outside of the plot limits.

(5) Your safest method of harvesting would probably be to cut the crops with a cradle after the oats have become sufficiently ripened, and then, when properly dried thresh with a flail.

(6) During the harvesting of the plots, watch carefully the requirements of the blank form on this page.

Individual results of 14 experiments:

Experimenter.	County.	Nature of soil.	Cropping of 1894.	When and how last manured.	Weight of grain on plot.				
					Mixture.	Nitrate of soda.	Superphosphate.	Muriate of potash.	No fertilizer.
					lbs.	lbs.	lbs.	lbs.	lbs.
R. Cinnamon	Dundas	clay loam	oats	never	18.5	18.0	17.0	17.0	15.0
T. Armstrong	Muskoka	heavy loam	potatoes	1888	30.0	35.0	30.0	25.0	24.0
J. Knight	Frontenac	clay loam	corn	1881, b.y.m.	48.0	44.0	46.0	44.0	38.0
J. H. Ferguson	Peel	"	sod	never	25.0	24.0	22.0	20.0	19.0
J. H. Herd	Grey	sandy loam	hay		20.0	22.0	17.0	23.0	15.0
W. Buskin	Grey	light loam	peas	1891, b.y.m.	18.0	16.0	16.0	15.0	12.0
Geo. Johnson	Victoria	clay loam	timothy	1888	16.0	15.0	16.0	21.0	19.0
Jas. Abell	Lambton	sand and clay	hay	1890, b.y.m.	14.0	17.0	13.0	12.0	8.0
H. McPhee	Huron	sand loam	hay		12.0	12.0	16.5	15.0	9.0
C. D. Lawrence	Parry Sound	sandy clay loam	potatoes	never	25.5	20 0	28.0	21.0	24.0
T. E. Bowman	Waterloo	sandy loam	oats	1892, b.y.m.	17.3	12.5	15.0	14.0	14.5
J. H. Cook	Wellington	clay	spring wheat.	never	21.0	19.8	20.5	18.8	21.0
O. A. College	Wellington				19.8	19.6	18.6	19.0	18.7
E. Minogue	Russell	clay loam		1889	14.0	18.0	15.0	12.0	11.0

It will be observed by a study of the above table that in some instances the fertilizers had but very little effect upon the crops, while in other instances, the advantage from the fertilizers was very marked. In one instance it will be noticed that the nitrate of soda gave more than double the yield of grain per acre, as compared with the unfertilized plot. These experiments should give a good index to the fertility of the land upon which they were sown.

The mixed fertilizer was made up of nitrate of soda, muriate of potash, and superphosphate, in the proportion of one, one, and two, by weight. The nitrate of soda was applied at the rate of 160 pounds per acre, when the plants were about two inches in height the muriate of potash was applied at the rate of 160 pounds per acre at the time of sowing the grain; and the superphosphate was applied at the rate of 320 pounds per acre, also at the time when the grain was sown. One-third of each of these fertilizers was used for the mixture. Each of the three fertilizers used cost about $400 per acre, for the amount applied. The following table gives the average results:

Fertilizers.	Average yields, 1895		Average yields, 4 years 59 tests.	
	Straw.	Grain.	Straw.	Grain.
	tons.	bush.	tons.	bush.
Mixture	1.1	50.3	1.3	48.4
Nitrate of soda	1.0	49.2	1.3	45.9
Superphosphate	1.0	48.9	1.2	42.9
Muriate of potash	1.0	46.5	1.2	42.8
No fertilizer	.8	41.7	1.1	38.2

Conclusions.

1. The average results obtained by fourteen experiments over Ontario in 1895 show that the fertilizers increased the oat crop as follows:

Mixture. Grain, 8.6 bushels; straw, .3 tons.

Nitrate of Soda. Grain, 7.5 bushels; straw, .2 tons.

Superphosphate. Grain, 7.2 bushels; straw, .2 tons.

Muriate of Potash. Grain, 4.8 bushels; straw, .2 tons.

2. The mixed or "complete" fertilizer gave an average increased yield of 20.6 per cent.; nitrate of soda, 18 per cent.; superphosphate, 17.3 per cent., and muriate of potash, 11.5 per cent. of oats over no fertilizer.

3. The grain crop was more than doubled upon some soils by the use of fertilizers, while upon others it was influenced to a very limited extent.

4. In 50 per cent. of the individual experiments, the mixed fertilizer was unsurpassed by any of the other fertilizers used in this experiment.

5. For four years in succession the mixed fertilizer has given the best average yield of grain per acre; nitrate of soda has given the second largest yield of grain; and no fertilizer has given the smallest average yield of grain per acre.

6. The different fertilizers used in this experiment gave the same comparative yield of grain per acre in 1895, as in the average of four years.

7. In the average of four years' experiments it is found that land fertilized with the mixture has produced 10.2 bushels per acre more oats than land which was unfertilized.

II. NITRATE OF SODA AND NO FERTILIZER WITH RAPE.

(1) From a section of ordinary land, to which no manure has been applied for at least four years, measure out two uniform plots, each 1 rod wide by two rods long, and leave a path three feet wide between the plots.
(2) Prepare the soil for rape in much the same manner as you would that for a root crop.
(3) In each plot make eight drills, two rods long, leaving twenty-five inches between the rows.
(4) During the last week in June, sow the two packages of rape seed upon their respective plots.
(5) When the young plants are about two inches high, sow the sodium nitrate upon plot No. 1, after which stir the soil.
(6) Cultivate the land in the same manner as you would that having a root crop.
(7) About the 20th of October cut the rape and immediately weigh the crop from each plot.

In 1895, there was only one successful experiment in determining the value of nitrate of soda in the growth of rape. The soil upon which this experiment was conducted was an average clay loam, and the land grew a crop of peas in 1894.

Nitrate of soda was applied at the rate of about 80 pounds per acre upon plot No. 1, and plot No. 2 was left unfertilized. The cost of the fertilizer would amount to about $2 per acre. Dwarf Essex variety of rape was used.

Nitrate of soda with no fertilizer, with rape for four years in succession:

Fertilizer.	Yield of crop per acre, (tons.)				
	1892. 1 test.	1893. 1 test.	1894. 2 tests.	1895. 1 test.	Average 4 years.
Nitrate of soda	20.0	9.2	15.2	18.3	15.7
No fertilizer	18.0	4.0	14.8	16.8	13.4

CONCLUSIONS.

1. For four years in succession the application of nitrate of soda increased the growth of rape in the co-operative experiments, the average increase being 2.3 tons per acre.

2. Rape can be grown successfully over Ontario to produce an average of about 14 tons of green crop per acre.

3. The demand for rape seed for experimental purposes is still very limited.

III. TESTING FOUR VARIETIES OF MILLET.

(1) Measure off four uniform plots, each two rods long by one rod wide, leaving a path of two feet between each two consecutive plots.
(2) Prepare the land similar to that for a corn crop.
(3) Sow broadcast the four packages of millet seed upon their repective plots during the first week in June. Aim at seeding one inch deep.
(4) Cut the crop as soon as all the heads are in appearance.
(5) Weigh the produce from each plot immediately on cutting.

Individual results of 5 experiments:

Experimenter.	County.	Nature of soil.	Cropping of 1894.	How and when last manured.	Weight of green millet on plot.			
					Salzer's Dakota.	Golden Wonder.	Common.	Hungarian Grass.
					lbs.	lbs.	lbs.	lbs.
W. R. Weese	Prince Edward	black clay	oats	1893	300	250	200	200
E. Butterworth	Victoria	clay loam	roots	1894	200	150	120	100
J. F. Beam	Welland	black loam	oats	never	203	215	174	87
C. Campbell	Huron		potatoes	1894, b. y. m	250	190	140	90
O. A. College	Wellington	clay loam	peas	1894, b. y. m	207	237	180	172

The millet was sown at the rate of forty pounds per acre in each instance.

Average results of experiments with millets for four years in succession:

Varieties.	Yield of green crop per acre, (tons.)				
	1892. 4 tests.	1893. 2 tests.	1894. 5 tests.	1895. 5 tests.	Average of 4 years, 16 tests.
Salzer's Dakota	8.1	9.3	6.1	9.3	8.2
Golden Wonder	5.8	7.1	5.7	8.3	6.7
Common	5.2	5.8	4.0	6.5	5.4
Hungarian	.....	.....	3.3	5.2	.....

Conclusions.

1. The varieties of millets tested over Ontario during the past four years hold the same relative position in yield of crop per acre in each of the four years.

2. Salzer's Dakota millet gave an average increase of green fodder of 55.8 per cent. in 1892; 53.6 per cent. in 1893; 53.2 per cent. in 1894, and 43.1 per cent. in 1895 over that of any of the other millets in the co-operative experiments.

3. Among the four varieties of millet tested in 1895, the Salzer's Dakota gave the best yield of green crop per acre in 60 per cent. of the individual experiments which we conducted.

IV. THE GROWING OF LUCERNE.

(1) For either experiment select a plot one-tenth of an acre in size. Four rods square is a good shape.
(2) As the lucerne is a perennial, the plot should be conveniently situated to the stables and in a position that it may remain unbroken for a number of years. The lucerne may either be sown alone or with a lighter seeding of grain.
(3) Cultivate the ground thoroughly, making a fine seedbed.
(4) Sow the 1½ lbs. of lucerne in the same way you would sow red clover.
(5) The lucerne should not be cut the first year unless the crop is heavy, and then not closely.

The lucerne was sown broadcast upon plots one-tenth of an acre in size, and the seed was sown at the rate of eighteen pounds per acre, and in most instances no grain crop was sown with the lucerne.

The results of thirty-six experiments with lucerne, seeded in the spring of 1895, showed that the average height of crop in the autumn was 10.6 inches as compared with an average of 11.8 inches for the four years (94 tests).

Conclusions.

1. The lucerne under experiment over Ontario during the past year varied in height from six to twenty-six inches.

2. A crop of lucerne cannot be expected during the same season in which the seed is sown; although the catch in 1895 seemed to be fairly good.

3. As lucerne is a perennial plant the most important results of the experiments will be obtained after the tests have been continued for a number of years.

V. THE GROWING OF CRIMSON CLOVER.

(1) For either experiment select a plot one-tenth of an acre in size. Four rods square is a good shape.
(2) As crimson clover is an annual, the land can be plowed in 1896. The crimson clover should be sown alone in every instance.
(3) Cultivate the ground thoroughly, making a fine seedbed.
(4) Sow the one and one-fifth pounds of crimson clover in the same way you would sow red clover.
(5) The crimson clover should be cut as soon as it comes out into bloom, and then weighed immediately on being cut.

The crimson clover seed was sown broadcast at the rate of twelve pounds of seed per acre. In a few instances, seed was sown in April; but in the majority of experiments it was sown during May.

Individual results of 36 experiments with Lucerne :

Experimenters.	County.	Nature of soil.	Nature of subsoil.	Character drainage.	Height of plants.	Remarks.
					inches.	
R. H. Harding	Middlesex	loamy	heavy	tile	10	Lucerne promises well.
N. A. Crozier	Haldimand	gravelly loam		underdrained	8	I am well satisfied, and think it will make good hay.
John Holbrook	Haldimand	black clay	black clay	slanting surface.	12	Crop uniform. Had it been cut it would have weighed half a ton per acre.
G. Hicks	Haldimand	gravelly	gravel	soakage	6	I am satisfied now that I have a green food that will be successful, as it does not heave by the frost.
A. Kennedy	Dundas	clay and gravel	hard pan	good natural	8	Do not think it will be profitable in this section of Dundas.
B. Mannen	Brant	clay loam	clay	fair	10	
K. McNaughton	Bruce	sandy loam	limestone & sand	good natural	6	I think it will catch better than red clover. We have a good stand of lucerne, while clover is all killed out.
Jno Kenner	Haldimand	gravelly loam	limestone	sidehill slope	8	I am well pleased with lucerne and am sure of success.
Jas. Partridge	Simcoe	clay loam	heavy clay	natural	6	I sowed it with grain and it did not do well until the grain was cut, but is doing well since.
J. F. Mannen	Wentworth	sandy loam	clay	surface	4	Crop is fairly uniform.
S. Brodie	Grey	clay loam	gravel	natural	12	Lucerne is looking well. If it stands the winter well it will be a profitable crop.
A. T. Horne	Ontario	clay and gravel.	gravelly	very dry	5	Started well, but land and season were too dry.
Jno. Hunter	Lambton	clay loam	limestone, clay	tile	8	Lucerne thin but healthy.
Jno. Priddle	Norfolk	sandy loam	sand	medium high	12	About half a crop. Kept back by the drouths.
J. H. Gray	Oxford	clay loam	gravelly clay	none	16	In my opinion lucerne is going to take first place among the clovers if it winters well.
T. H. Sissons	Carleton	mucky clay	clay	dry	26	Not very heavy on account of dry season.
A. Betz	York	clay loam	sand	natural	9	Started well but frost cut it back ; however, it is doing well again.
F. Fach	Norfolk	sand	quicksand		7	The lucerne stood the drouth better than any other grass seed I sowed this season.
T. B ettles	Huron	loam	gravel	natural	12	Crop uniform.
E. Butterworth	Victoria	sandy loam	gravel	none	6	
Wm. Dawson	Norfolk	sand	gravelly quicksand		8	Lucerne stood the drouth all right while red clover is all gone.
H. P. Westgate	Lambton	clay loam	clay	furrow at end of plot	13	Almost a failure on account of drouth.
S. M. Billings	Durham	clay loam	clay	natural	8	A fine catch.
J. Bedford	Elgin				8	Almost a failure on account of drouth and frost.
B. E. White	Lanark	sandy	clay	good natural	14	Lucerne was sown with oats and the whole cut about 12th July ; afterwards it sprang up and gave good grass. I think it should be more extensively grown as it stands drouth well.
Jno. A. Julien	Kent	sandy	quicksand		13	An even catch.
C. S. Smith	Haldimand	red clay	black clay	slanting surface.	9	I am well pleased with lucerne.

S. G. Holbrook	Haldimand	black clay	loam	rolling surface	12	Seed germinated quickly as the soil was moist. Crop very even.
J. D. Stewart	Perth	clay loam	limestone	tile	10	Crop uniform.
Geo. Baker	Simcoe	sandy loam	sand	natural	8	
Wm. H. Clubine	York				18	Lucerne started well and was cut with the oats, and afterwards grew to a height of 18 inches, when it was pastured off and again grew to a height of 8 inches before winter.
G. A. Brodie	York	clay loam	sandy	well und'rdrain'd	18	Am well pleased with lucerne. Drouth apparently did not affect it.
G. S. Hull	Middlesex	clay loam	red clay	tile	13	Lucerne was quite thick. I think it is a good kind of clover and will grow more of it next season.
Jno. Hilbert	Northumb'rl'nd.	stiff clay	clay	hillside	12	Very even.
J. Lapp	Victoria	clay loam	heavy clay	not drained	14	It was sown with wheat. After wheat was cut it was pastured off and afterwards grew up thickly to a height of 14 inches.
Jno. Hamilton	Russell	clay	clay	good	15	A very light crop on account of cold, wet spring.

Individual results of 36 experiments with Crimson Clover:

W. H. Mallett	Wellington	sandy loam			10	Weight of the crop 700 lbs. Owing to dry weather and frost after the clover came up the crop was short. We cut on 1st August.
D. H. Cohoe	Welland	clay	clay	surface drainage	6	Season too dry until late in the fall, when it took quite a growth, matted the ground, and came in blossom when nothing else was in bloom. Stood the frost well. Think it will be a great fertilizer.
Geo. Aspden	Simcoe	clay loam	mixture clay and gravel	natural	6	I think crimson clover would be a good thing in a favorable season.
U. S. Waltin	York				20	Made little growth owing to dry weather until end of August; when rain came it looked beautiful. The blossoms attracted the bees and worked every day until frost came. Cut in October.
R. M. Quickfall	Waterloo	heavy loam	clay mixture	good, natural	11	Did not come into blossom early. Was very bushy.
J. L. Groyean	Northumberland	clay loam	clay		10	Season too dry. It all headed out. Cattle and horses ate it down before second growth of red clover, and kept it eat down when the clover was high.
Wm. Mobray	Lambton	good soil			6	Slow in coming up owing to dry weather. Most of it has gone to seed. Too short to cut.
H. D. Buckley	Wentworth				4	Failure caused by frost.
Robt. Thompson	Lincoln				12	Owing to dry weather it made slow growth, but after 1st September it shot up and bloomed and made a good heavy growth of about one foot high on clay soil. Have sown 4 acres to winter over.
Robert Findlay	Algoma	clay loam	heavy clay	natural	6	Not cut.
C. M. Johnson	Lincoln	clay loam	clay	surface	6	Not cut. Germinated quickly. Dry weather set it back and made crop short.
Windle Johnson	Lincoln	clay loam / black ground	clay	surface	7	Uncut. Grew well considering dry weather.
W. M. Leigh	Perth	peaty clay	red clay	tile	2 ft. 4	Seeds sown April 24th.
John A. Turnbull	Perth	sandy loam	inclined to gravel	natural	8½	Weight, 430 lbs. Frost in May hurt the clover. Cut it August 15th.

Individual results of 36 experiments with Crimson Clover—*Concluded.*

Experimenters.	County.	Nature of soil.	Nature of subsoil.	Character of drainage.	Height of plants.	Remarks.
					inches.	
D. H. Clemens	Oxford	rich sandy loam.	yellow soil	natural	12	Seeded down a piece last spring. Was 14 inches high when frost came. Pastured it off; cut it twice, and now there is clover about a foot high.
J. F. Manner	Wentworth	sandy loam	clay	surface	5	Did not make much growth, weather being too dry.
Francis Taylor	Grey	clay loam	inclined to harden after 8 or 12 inches.	natural	1 ft. 6	Crop weighed 400 lbs. soon after being cut, area 4 rods square.
John Hunter	Lambton	muck and clay	clay	tile	15	Crop not very good owing to drouth. Sheep and cows like it, increases the flow of milk.
R. H. Harding	Middlesex	loamy	heavy	tile	12	I would not advise it in large quantities. I sowed an acre besides the test and it never grew fit for cutting.
J. L. Edmonston	Grey	sandy loam	gravel	stone	7	Heads full of seed; too short to cut.
Thos. Paterson	Middlesex	gravelly loam	clear gravel	natural	15	As it was so thin it was not cut.
Edmond Prout	Durham	sandy loam	lay	good	5	Season too dry.
W. D. Foss	Oxford	sandy loam	porous	natural	8	Frost on May 13th killed more than half the plants. I doubt if the crimson clover will make a crop of hay to cut the same season.
Thos. S. Bettles	Huron	clay loam	clay	natural	12	Uniform crop.
Alfred Smith	Brant	sandy loam	clay	natural, good	7	It was growing nicely when frost came and killed it back. A large amount of it never seemed to start again. Ground was in good condition, but the season was too dry.
Wm. Dryden	Bruce	light loam	sandy	good, natural	11	Weight of crop 590 lbs.
Otto Moser	Wellington	sandy loam		natural	21	Weight 1,600 lbs. of crop. The hay shows finer stems with more leaves than red clover. Cut August 30th.
Moses Pierce	Middlesex	clay	clay	well drained	12	Owing to dryness of season germination was slow. Would likely produce a good crop in an average season.
R. C. McGowan	Huron	dark loam	reddish clay	underdrained	24	The clover got badly frozen in spring, but late rains made it grow well. In a good season this clover should produce good yield. Had 1,632 lbs. of crop.
Michael Chipsham	Muskoka	clay loam	hard clay	undrained	18	Weight of crop 687 lbs. Season too dry. Think it will be a grand thing for the sandy soil of this country.
Ed. Butterworth	Victoria	sandy loam	rock 2 ft. deep		12	Even throughout.
Chas. Bard	Muskoka	sandy loam	hard pan	slope natural	15	Seeds sown May 18th.
Jno. Burns	Perth	clay loam	limestone clay	good natural	11	Came up very slowly and at the time of germination we had severe frosts which retarded the growth very materially Came into bloom very unevenly. Think under good cultivation it will yield almost as much as common red clover.
S. M. Billings	Durham	clay loam	clay	natural	8	
Alex. Mitchell	Wentworth		clay	natural	6	Weight of crop 90 lbs.
T. G. Raynor	Prince Edward	sandy loam	clay loam	natural	5	Crimson clover quite uniform throughout.

The results of thirty-six experiments with crimson clover showed that the average height was 11.1 inches, and the average green crop in eleven tests was 4.35 tons.

Conclusions.

1. The crimson clover plants reached a little greater average length than those of the lucerne during the same season.

2. The summer of 1895 appeared to be a severe one for the growth of crimson clover, owing to the exceedingly dry weather.

3. In the average of four years' experiments with crimson clover at the College the yield has been about 1.1 tons of hay per acre, and in the co-operative experiments over Ontario in 1895, the average amount of green crop per acre was 4.35 tons.

VI. TESTING SIX VARIETIES OF CORN.

(1) Measure off six plots, each one rod square.
(2) Mark out each plot into five rows both ways, allowing in every case three feet four inches between two consecutive rows.
(3) Plant each variety of corn upon its respective plot. Drop six kernels at each of the places where the lines touch, and thus make twenty-five hills of each variety.
(4) When the corn is about four inches high, thin out to four plants per hill.
(5) Cultivate all the plots alike, and take necessary notes during the summer for the report.
(6) Cut each variety before frost, and at the time when its stage of growth corresponds to the roasting condition of field corn, or when the grain is partly glazed.

Individual results of 28 experiments :

Experimenter.	County.	Date of planting.	Nature of soil.	Cropping of 1894.	Weight of whole crop per plot.					
					Clond's Early Yellow.	Rural Thoroughbred White.	Mammoth Cuban.	Improved Leaming.	Salzer's North Dakota.	Compton's Early.
					lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
S. M. Billings	Durham....	May 26	clay loam	barley.....	66	88	52	55	39	33
David Brown	Ontario	do 28	heavy clay....	peas	209	215	197	183	149	159
Duncan McVannel	Perth	do 23	clay loam	barley.....	252	246	175	220	185	195
E. G. McCallum..	Glengarry ..	do 23	clay	hay	191	221	238	181	137	101
P. R. Longworth .	Kent	do 10	black clay....	peas & oats.	349	355	345	300	260	200
John McKee	Oxford	do 28	sandy loam ..	potatoes ..	291	249	245	232	190	155
Howard W. Russell	Russell	do 25	clay loam	hay	312	283	246	226	171	155
A. Munro	Parry Sound	do 28	clay loam	carrots	182	178	180	186	160	154
Jas. Grant	Renfrew ...	do 28	clay loam	corn	224	172	192	204	120	112
J. F. Dix	Victoria....	do 25	clay loam	alsike	86	90	70	70	65	52
Jas. D. Rose	Wentworth.	do 25	clay loam	hay	75	106	88	85	85	72
John Lancaster ..	Peterboro'..	do 25	clay loam	potatoes ...	211	250	167	145	155	146
D. H. McDougal .	Glengarry ..	do 18	gravel loam ..	potatoes ...	385	330	295	250	260	150
W. J. Wilson	Dundas	do 29	sandy loam ..	meadow ...	189	207	168	171	192	129
D. D. Kellington..	York	do 25	clay	.....	206	175	180	195	187	150
E. P. Wilson	Norfolk	do 31	sandy loam ..	.....	170	190	155	160	132	135
Wm. Kir-tine ...	Bruce	do 25	sandy loam ..	mangels ...	248	433	320	267	218	212
Edgar M. Husband	Middlesex .	do 31	heavy cl'y loam	mangels ...	182	144	192	198	114	120
Chas. Shisler	Welland ...	do 27	clay loam	... .	94	68	106	86	87	72
D Hartley	Halton	do 25	light loam....	turnips	147	157	153	195	154	114
David James	York	June 1	clay loam	barley.....	235	143	139	130	152	134
Peter McNaughton	Middlesex .	do 5	rich loam	peas.....	286	256	268	264	200	196
Wm Magee & Son	Durham....	May 27	clay loam	{ timothy & clover }	191.50	184	164.50	173.50	144.50	143
R. A. Butler ...	Lambton ..	do 24	sandy loam ..	oats	176	203	142	118	90	87
G. W. Sutherland	Lambton ..	do 28	clay	sod	440	330	358	326	285	240
Dan Campbell....	Dundas	do 30	clay loam	potatoes ...	235	165	200	240	180	175
J. F. Wilson	Oxford	do 25	clay	peas.....	180	160	190	100	100	130
Wesley W. Fisher	Huron	do 29	clay loam	oats	149.5	148	184	204	85	104

Average results of 28 experiments:

Varieties.	Average condition about 15th Sept. at O. A. C. for five years.	Height of crop.	Number of ears per plot.		Yield per acre.	
			Good.	Poor.	Ears.	Whole crop.
					tons.	tons.
Cloud's Early Yellow	Late milk	103	33	40	4.0	17.1
Rural Thoroughbred White Flint	Milk	92	32	38	3.2	16.4
Mammoth Cuban	Firm dough	99	52	36	4.2	15.6
Improved Leaming	Firm dough	96	52	35	3.7	14.9
Salzer's North Dakota	Ripe	82	68	29	3.6	12.4
Compton's Early	Ripe	77	56	35	3.3	11.2

Conclusions.

1. It is considered that the best variety of fodder corn for any section in Ontario is the variety which will produce the largest amount of fodder by weight, combined with the largest yield of grain, and that will mature before frost comes in the section where grown.

2. The four varieties of corn which were sent out in both 1895 and in 1894 give the same comparative average yield of whole crop per acre for the two years.

3. The largest number of well developed ears was produced by the Salzer's North Dakota, and the smallest number of well developed ears was produced by Rural Thoroughbred White Flint.

4. The individual experiments show that no one variety of corn is equally well suited to all parts of Ontario.

5. Among fifty-five varieties of corn tested for five years in succession at the Agricultural College, the Cloud's Early Yellow and the Rural Thoroughbred White Flint seemed about the best adapted for Southern Ontario; Mammoth Cuban and the Improved Leaming for Central Ontario; and the Salzer's North Dakota and Compton's Early for Northern Ontario.

6. In the co-operative experiments over Ontario in 1895 the Cloud's Early Yellow appears to have given better all-round satisfaction than the Rural Thoroughbred White Flint; the Mammoth Cuban better than Improved Leaming; and the Salzer's North Dakota better than Compton's Early.

VII. TESTING FIVE VARIETIES OF TURNIPS.

(1) Five plots, each containing 272 square feet are required for the experiment with Turnips, or Mangels or Carrots.

(2) The drills for the roots should be twenty-five inches apart.

(3) Make all plots alike and arrange each plot according to one of the following plans: (*a*) Eight drills, sixteen feet four inches long; or (*b*) four drills, thirty-two feet eight inches long; or (*c*) two drills, sixty-five feet four inches long.

(4) Sow the different varieties upon their respective plots.

(5) Thin young plants in the rows to the following distances apart: Mangels and Turnips, ten inches; Carrots, four inches.

(6) Be careful of the plants when cultivating and hoeing the ground.

As the number of roots of the different varieties of turnips in each experiment were not exactly uniform, the average weight per root was determined and will be seen in the following summary table, as well as the yield of roots per acre. This was a very unfavorable season for the experiments with turnips, and a large number of failures were reported.

Individual results of 13 experiments:

Experimenter.	County.	Nature of soil.	Cropping of 1893.	How and when last manured.	Yield of turnips per plot.				
					Greystone.	Jersey Navet.	Carter's Elephant.	Hartley's Bronze Top.	Marshall's Purple Top.
					lbs.	lbs.	lbs.	lbs.	lbs.
W. H. Crew	Northumberland...	sandy loam (new land).	peas	b.y.m., 1893	276.5	355.5	268	200 5	271
Isaac Fearon.....	Algoma west	clay loam..	.....	never	71	90	37	42	44
Donald McLaren.	Lanark	gravelly lo'm	carrots	.....	247	325	120	207	210
Louis Adolph	Perth	clay loam ..	fall wheat..	b.y.m., 1895	384	412	258	178	221
Henry McCormick	Brant	light loam..	barley.....	b.y.m., 1895	286	305	153	160	181
R. O. Smith.....	Middlesex..	clay loam ..	potatoes....	b.y.m., 1895	326	343	376	287	228
Angus Munro....	Parry Sound	clay loam..	carrots	1893	650	600	516	694	512
T. E. Bowman....	Waterloo ..	sandy loam.	oats	b.y.m., 1895	297	127	163	322	167
John B. Landon..	Leeds	sandy loam.	turnips.....	b.y.m.....	458	472	702	630	563
E. A. Skelly	Simcoe	clay muck..	1st crop	never	760	509	567	478	593
C. L. Johnson ..	Lincoln ...	clay loam..	beets.....	b.y.m.....	250	400	370	380	350
T. J. M. Skelley.	Simcoe	clay loam ..	fall wheat..	b.y.m., 1894, clover turned under..	645	400	590	511	460
Robt. Thompson..	Lincoln	sandy loam.	barley.....	b.y.m.,1895.	420	390	255	285	310

Average results of 13 experiments:

Varieties.	Class.	Average weight per root.	Yield per acre.
		lbs.	bush.
Greystone.....	fall turnips	2.8	1,114.4
Jersey Navet	fall turnips	2.5	1,039.2
Carter's Elephant.....	Swede turnips.....	2.3	961.5
Hartley's Bronze Top	Swede turnips.....	2.2	961.4
Marshall's Purple Top.....	Swede turnips.....	2.0	903.3

Conclusions.

1. The fall turnips gave a larger yield of roots per acre than the Swede varieties in the co-operative tests of 1894 and 1895.

2. The Jersey Navet did not give as high results over Ontario when compared with the Greystone in the co-operative experiments in 1895, as in five years' trials with these too varieties at the Agricultural College.

3. Carter's Elephant and the Hartley's Bronze Top varieties of Swedes gave practically equal results in the Union experiments during 1895.

VIII. TESTING FIVE VARIETIES OF MANGELS.

Instructions.—Same as those given for turnips.

There were four varieties of mangels, and one variety of sugar beet tested in 1895. The varieties of mangels used for the co-operative experiments were two long varieties, one Intermediate and one Globe variety; these had given the largest average yield per

acre on their respective classes of all the mangels grown at the Agricultural College for four years. The variety of sugar beet used also stood at the head of the list among the varieties tested at the College.

Individual results 22 experiments.

Experimenter.	County.	Nature Soil.	Cropping 1894.	How and when last manured	Weight of roots on plot.				
					Improved Mammoth Saw-Log.	Improved Mammoth Long Red.	Carter's Warden Orange Globe.	Carter's Champion Yellow Intermediate.	White Silesian Sugar Beet.
					lbs.	lbs.	lbs.	lbs.	lbs.
A. M. Ross	Middlesex..	clay loam.....	potatoes...	Fall 1894...	300	300	280	326	250
Cyrus Davis.....	Lanark.....	loam	onions.....	1895.....	560	959	348	540	574
J. B. Muir.....	Bruce	loam with clay subsoil...	corn.....	1894.....	340	346	390	234	241
Geo. L. Fair.....	Durham	.....	.....	.....	303	242	183	140	162
Jas. Chisholm.....	Waterloo ...	sandy loam...	wheat	1895.....	248	254	310	204	210
K. B. Sutherland...	Oxford	clay loam.....	corn.....	1895.....	925	270	710	620	725
Wm. Watson.....	Lanark.....	"	potatoes....	1894.....	499	477	349	319	417
Geo. Adams.....	Lincoln	rich loam.....	oats.....	never	1,241	1,127	902	1,187	897
Wm. Jackson	Huron.....	clay loam.....	potatoes ...	hen m., 1895.	153	192	232	85	240
W. D. Ventress ...	Victoria ...	sandy loam...	potatoes....	1895.....	235	186	192	197	166
David James.	York.....	clay loam.....	pease.....	b.y. m. 1895.	480	681	298	198	290
Richard Connolly...	Oxford	"	potatoes....	b.y.m. 1895.	1,075	958	710	600	776
Francis Morley.....	Huron.....	clay loam.....	.....	b. y. m.	485	389	334	307	385
Henry Jacobs.....	Muskoka ...	sandy loam...	carrots.	1895.....	210	183	203	150	142
W. K. Foreman	Muskoka ...	loam	"	b.y.m	500	435	450	450	325
John Mosser.....	Wellington .	sandy loam...	"	b.y.m. '94..	756	870	745	496	485
R. McDonald	Glengary ...	"	wheat	never	293	402	278	365	315
Jas. A. Neilson.....	Leeds	"	turnips.....	.....	366	320	358	322	338
Jas. Bell.....	Lanark.....	clay "	onions.....	b.y.m. '94..	418	296	302	230	256
C. L. Johnson.....	Lincoln	" "	mangels....	.....	900	894	616	775	480
R. Thomson.....	Lincoln	light clay loam	tomatoes ...	1894.....	485	415	265	510	290
Thos. W. Stephens	York.....	....	....	.....	592	631	343	341	331

Average results of 22 experiments.

Varieties.	Average weig per root.	Yield per acre.
	lbs.	bush.
Improved Mammoth Saw Log.....	4.4	1,284.6
Improved Mammoth Long Red	4.8	1,258.7
Carter's Warden Orange Globe	3.2	980.6
Carter's Champion Yellow Intermediate	3.7	953.7
White Silesian Sugar Beet.....	3.1	857.9

Conclusions.

1. The Improved Mammoth Long Red and the Improved Mammoth law Log varieties of mangels gave the largest average roots, and the White Silesian Sugar Beet gave the smallest average yield of roots among the varieties tested over Ontario in 1895.

2. The White Silesian Sugar Beet requires much more labour in removing the roots from the land than any of the mangels used on the experiment.

3. There were only about ninety per cent. as many roots of the Intermediate variety as there were of the Globe variety, therefore the average weight per root mentioned in the above table is of great value in comparing the different varieties under experiment.

IX. TESTING FIVE VARIETIES OF CARROTS.

INSTRUCTIONS.—Same as those given for turnips.

Individual results of 27 experiments.

Experimenter.	County.	Nature of soil.	Cropping 1894.	How and when last manured.	Weight of roots on plot.				
					Improved Short White.	Large White Vosges.	Large White Belgian.	Guerande.	Danver's Orange.
					lbs.	lbs.	lbs.	lbs.	lbs.
Thos. Canfield	Ontario	sandy loam		b.y.m. 1894.	387	325	295	286	255
A. E. Quinn	Muskoka	" "	turnips		352	261	156	279	198
A. Chisholm	Waterloo	" "	wheat	b.y.m. 1895.	400	220	260	180	125
J. S. Bell	Lanark	heavy clay		b.ym.	360	340	300	320	300
Nicholas DeHart	Simcoe	light clay	buckwheat	b.y.m. 1894.	456	441	406	434	423
W. D. Ventrese	Peterboro	sandy loam	[illegible]	1895	193	228	162	182	138
David James	York	clay loam	peas	b.y.m. 1895.	558	487	418	334	303
Roscoe E Law	Nipissing	clay muck	none	new land	160	173	114	91	178
Jas. Clark	Glengarry	light soil	potatoes	1895	572	330	441	460	550
R. O. Smith	Middlesex	clay loam	corn	b y.m. 1894	424	456	308	176	184
Robert Russell	Bruce	sandy loam	oats		256	167	120	170	176
J. T. Smith	Parry Sound	sandy loam	rape	b y.m. 1894	460	464	376	328	380
John Henderson	Hastings	clay loam		b.y.m. 1894	224	244	213	196	168
Mark M. Clark	Perth	" "	oats		278	264	198	140	160
Will. J. Brady	Muskoka	" "	peas	b.y.m. 1895	285	223	74	94	147
W. J. Rent	Parry Sound	sandy loam	corn	b.y.m. 1895.	385	147	185	279	133
Geo. A. Miller	Grey	clay loam	peas	1895	518	448	316	290	320
Martin Johnson	Simcoe	" "	"		360	230	192	232	300
Thos. Canfield	Ontario	sandy	vegetables		387	325	295	286	255
C. L. Johnson	Lincoln	muck		new l'd none	500	460	510	490	524
T. J. M. Skelley	Simcoe	clay loam	mangels	b.y m. 1894.	718	637	590	496	410
Chas. Young	Algoma	sandy loam	mangels	b.y.m. 1894.	368	322	410	320	305
Thos. E. Cook	Monk	black clay	potatoes	b.y.m. 1894.	180	169	194	134	124
Donald McDiarmid	Kent	sandy		new ground.	331	300	335	270	290
Robert Oliver	Huron	sandy loam		b.y.m.	390	331	420	310	300
R. R Sangster	Glengarry				520	336	304	304	240
Leonard T. Leach	Simcoe	heavy loam	mangels	1894	250	200	184	118	160

Average results of 27 experiments.

Varieties.	Average weight per root 1895.	Yield of Roots per acre.	
		1895. 27 tests.	Average 3 years 80 tests.
		bush.	bush.
Improved Short White	1.4	1,086.6	1,015.0
Large White Vosges	1.1	901.4	880.5
Large White Belgians	1.0	892.4	850.9
Guerande	1.0	770.3	793.1
Danver's Orange	.9	754.1	792.1

CONCLUSIONS.

1. The Improved Short White took the lead in point of yield in fifty per cent. of the co-operative experiments during 1892; in forty-two per cent. of the co-operative experiments in 1893; in fifty-five co-operative experiments in 1894; and in sixty-three per cent. of the co-operative experiments in 1895.

2. The white fleshed varieties of carrots in 1895 gave better yield of roots than the yellow-fleshed varieties in 1893, 1894, and in 1895.

3. The Guerande was the easiest to remove from the ground and the Large White Belgian the most difficult to remove from the ground of all the varieties.

4. The five varieties gave the same comparative yield of roots per acre in 1895, as during the average of the three past years.

X. TESTING FIVE VARIETIES OF SPRING WHEAT.

(1) Select a portion of uniform soil and mark off five plots, for either spring wheat or barley, six plots for oats, or four plots for peas. Each plot should be one rod square. Allow paths three feet wide between the plots. Note.—To prevent the peas from hybridizing, the plots should be located at least 100 feet apart.

(2) Drive stakes at the four corners of each plot.

(3) Sow the different varieties upon their respective plots. It is an advantage to run a strong cord around each plot and sow inside the line.

(4) After the grain is up three or four inches, again run the cord around the plots and cut off any plants that happen to be outside the line.

Individual results of 13 experiments:

Experimenter.	County.	Nature of soil.	Cropping of 1894.	How and when last manured.	Yield of grain on plot.				
					Herison Bearded.	Red Fern.	Pringle's Champion.	Bart Tremenia.	Haynes' Blue Stem.
					lbs.	lbs.	lbs.	lbs.	lbs.
W. H. Cullis	Victoria	clay loam	barley	b.y.m., 1891	5.50	6.50	5.50	4.00	4.50
B. Tates	Simcoe	"	clover, 1893	1894	15.00	13.00	8.00	12.00	9.00
Gutlip Lantgz	Renfrew	new land			7.00	8.00	10.00	5.50	8.75
Robt. Ash	York	clay	buckwheat	b.y.m., 1894 / salt, 1895	15.00	9.00	11.00	13.00	10.00
J. Kinder	Renfrew	medium loam	timothy hay	b.y.m., 1895	3.50	2.06	2.13	1.22	2.25
A. Timmins	Dundas	gravelly	barley	1894	2.50	4.00	3.50	1.50	3.50
T. Robertson	Victoria	light loam	peas	b.y.m., 1888	2.38	2.19	2 25	2.13	3.06
R. Beneteau	Essex	clay	"	new land	7.75	6.50	6.50	5.50	6.00
F. R. E. DeHart	Ontario	black loam	"	new land	10.75	12.00	10.00	11.00	9.00
E. Cullis	Grey	light clay loam	carrots	b.y.m., 1894	4.25	4.00	3.75	3.00	4 00
Wm. Murray	Algoma	clay	potatoes	pasture land	12.00	9.00	7.00	8.50	10.00
J. F. Beam	Welland	black loam	oats	never.	11.00	6.00	8.50	10.00	5.00
Geo. Baker	Norfolk	sandy loam	rye	salt & ashes, '94	3.50	3.00	3.25	2.50	2.00

The Agricultural College imported the Herison Bearded spring wheat from France in 1889, the Pringle's Champion from Germany in 1889, and the Bart Tremenia from Greece in the same year. The Haynes Blue Stem was imported from North Dakota, where it had made a very high record at the North Dakota Agricultural Experiment Station in two years' trials. The Red Fern was obtained in Ontario, where it has been grown for a number of years. The following gives the average results:

Varieties.	Comparative value as determined by experimenters.	Yield per acre.	
		Straw.	Grain.
		tons.	bush.
Herison Bearded	100	1.3	20.5
Red Fern	93	1.6	17.5
Pringle's Champion	83	1.4	16.7
Bart Tremenia	52	1.4	16.4
Haynes' Blue Stem	67	1.5	15.8

CONCLUSIONS.

1. The Herison Bearded heads the list in yield of grain per acre in the average of twenty-nine co-operative experiments conducted in 1893, of nineteen co operative experiments conducted in 1894, and of thirteen co-operative experiments conducted in 1895.

2. The Herison Bearded was the most popular variety among experimenters among five varieties of winter wheat tested in 1895.

3. The Bart Tremenia variety of spring wheat stood the lowest in the estimation of the experimenters in 1895, it being a coarse quality of wheat.

4. The Herison Bearded spring wheat gave an average of three bushels per acre more than than Red Fern variety over Ontario in 1895, and the Red Fern stands the highest among all the Ontario varieties tested at the Agricultural College.

5. Herison Bearded has given the highest weight per measured bushel of all the varieties of winter wheat tested at the Agricultural College during the last seven years, and was selected as one of the best milling wheats among fifty-seven varieties examined by the Dominion Millers' Association.

XI. TESTING FIVE VARIETIES OF BARLEY.

INSTRUCTIONS.—Same as those given for spring wheat.

Individual results of 22 experiments:

Experimenter.	County.	Nature of soil.	Cropping of 1894.	How and when last manured.	Yield of grain on plot.				
					Mandscheuri.	Oderbrucker.	Two-rowed Italian.	Guy Mayle.	Kinna Kulla.
					lbs.	lbs.	lbs.	lbs.	lbs.
S. Westney	Ontario	str'ngs'd'ylo'm	peas	b.y.m., 1894	12.00	14.00	10.50	8.00	5.00
Wm. Field	Middlesex	heavy clay	oats	b.y.m., 1894	5.00	5.00	3.00	2.50	2 00
Geo. Mueller	Haldimand	new land	corn	never	7.00	6.00	4.50	7.00	4.00
Robt. Murphy	Simcoe	clay	fallow	b.y.m., 1892	5 00	5.00	3.50	6.00	3.00
F. Somerton	Lanark	heavy clay		1894	11.00	12.00	18.00	11.00	15 00
G. S. Docker	Elgin	clay loam	mangels	b.y.m., 1894	17.75	11.75	12.50	14.00	6.25
F. D. Roberts	Lincoln	clay	oats	b.y.m., 1895	8.00	7.50	7.00	6.00	5.00
R. B. Cowie	Ontario	clay loam	"	new land never	13.00	18.00	13.00	15.00	18.00
J. F. Campbell	Dundas	"	potatoes	b.y.m	12.00	9.00	10.00	8.00	9.50
J. Martineau	Prescott	loamy	beans	b.y.m., 1895	5.75	3.00	6.75	2.50	1.75
Wm. Williams	Haliburton	clay	oats	b.y.m. & lime '95	11.25	8.75	7.75	10.00	7.50
Jno. Speiran	Huron	clay loam	roots	b.y.m., 1894	11.50	10.00	6.00	9.00	5.50
A. Kennedy	Dundas	cl'y and gravel	potatoes	b.y.m., 1894	8.00	6.00	11.00	4.00	6.00
F. R. E. DeHart	Ontario	black loam	peas	new land never	13.00	12.00	9.00	10.50	10 00
E. Casselman	Parry Sound	sandy loam	potatoes	b.y.m., 1894	13.50	13.13	7.31	9.00	8.75
Jno. Hall	Grey	heavy cl'y lo'm	corn	b.y.m., 1894	14.75	12.25	13.25	18.00	15.25
Jno. Bell	Grey	clay loam	peas, oats & barley mixed	b.y.m., 1894	17.50	13.50	13.50	12.50	13.00
Wm. Tiplady	Huron	"	oats & barley mixed	b.y.m., 1893	8.75	7.75	9.75	9.25	6.50
Wm. Ramage	Grey	sandy loom	potatoes	b.y.m., 1894	5.75	4.75	4.25	3.50	4.25
J. F. Beam	Welland	black loam	oats	never	13.00	8.00	12.00	6.50	10.25
R. Kelly	Peel	clay	peas	b.y.m., 1893	12.25	7.75	7.25	7.50	7.00
Wm. Rynard	Ontario	"	"	b.y.m., 1893	7.00	6.00	6.00	6.00	4.00

The Ontario Agricultural College imported the Mandscheuri variety of barley from Russia; the Oderbrucker from Germany; the Two-rowed Italian from Italy; the Guy Mayle from the United States, and the Kinna Kulla from Sweden. The Mandscheuri and Oderbrucker are six-rowed varieties, the Two-rowed Italian and Kinna Kulla are two-rowed variety, and the Guy Mayle is a hulless barley. In giving the yield of the Guy Mayle, forty-eight pounds to the measured bushel was used as in the case of the other varieties.

Average results of 22 experiments:

Varieties.	Comparative value as determined by experimenters.	Yield per acre.	
		Straw.	Grain.
		tons.	bush.
Mandscheuri	100	1.1	35.3
Oderbrucker	84	.9	29.7
Two-rowed Italian	72	1.2	29.6
Guy Mayle	53	.9	28.1
Kinna Kulla	31	.9	25.4

CONCLUSIONS.

1. The Mandscheuri variety of barley gave the highest yield of grain per acre in the co-operative tests for 1892, 1893, 1894 and 1895.

2. The six-rowed varieties of barley have surpassed the two-rowed and hulless varieties in the co-operative experiments over Ontario for four years in succession.

3. Mandscheuri variety was surpassed by no other variety in seventy-five per cent. of the co-operative experiments over Ontario in 1894, and in sixty-four per cent. of the experiments in 1895.

4. The Two-rowed Italian barley gave an average yield of grain in 1895 almost equal to the Oderbrucker, which is a six-rowed variety.

5. The Mandscheuri variety of barley was most popular of the varieties tested among experimenters in 1895, and the Kinna Kulla was the least popular.

XII. TESTING SIX VARIETIES OF OATS.

INSTRUCTIONS.—Same as those given for spring wheat.

Individual results of 79 experiments:

Experimenter.	County.	Nature of soil.	Cropping of 1894.	How and when last manured.	Yield of grain per plot.					
					Siberian.	Bavarian.	Joanette.	Oderbrucker.	Besthorne.	Poland White.
					lbs.	lbs.	lbs.	bs.	lbs.	lbs.
Geo. Baird, Sr.	Huron	clay loam	fal wheat	b.y.m., 1893	16.50	14.50	18.00	15.00	14.50	14.00
Wm. Fitzgerald	Bruce	.....	clov'r past're	b.y.m., 1892	9.00	12.00	7.00	11.00	15.00	10.00
F. Kosmack	Renfrew	yellow loam	wheat	never (n. l'd)	11.88	9.06	11.63	7.50	11.00	8.25
Jos. Ingles	Lambton	clay loam	"	never	10.00	11.00	10.00	10.50	9.00	11.50
Wm. Sadler	Middlesex	"	fall wheat	b.y.m., 1893	13.00	17.00	10 50	15.00	11.00	11.50
R. W. Mowbray	Ontario	"	turnips	new land	17.00	16.00	19.00	12.50	21.00	16.00
C. White	Lambton	sandy loam	mangels	b.y.m., 1894	15.00	14.00	12.00	13.50	10.50	16.50
Jno. Armstrong	Stormont	loam	carrots	b.y.m., 1893	11.50	12.50	10.50	13.00	11.50	11.00
Frank Shuh	Waterloo	sandy loam	fall wheat	1893	9.00	9.50	7.25	8 75	8.00	7.25
R. S. Rennie	York	bl'k cl'y loam	barley	1888	1.00	14.00	11.00	11.50	11.50	10.00
P. D. Campbell	Lanark	clay loam	peas	no manure	10.00	10.00	12 00	9 00	13.00	10.00
W. McGregor	Ontario	clay	wheat	5 years ago	9.00	8.00	10.00	7.50	5.50	5.50
A. McKellar	Lambton	"	oats	1889	8.13	7.63	7.13	5.63	6.19	7.56
M. M. Cardiff	Huron	clay loam	fall wheat	1894	7.50	11.00	10.00	10.50	9.00	9.00
J. Boyes	Ontario	good clay	pasture		0.50	13.00	16.50	14.00	11.00	12 00
Jas. Fraser	Renfrew	loam	barley	1894	9.00	11.00	9.00	13.00	9.00	8.00
Wm. Worden	Perth	loamy	fall wheat	b.y.m., 1893	11.75	7.25	9.50	9.00	11.00	9.25
Wm. Paterson	Lanark	clay loam	peas & oats.	6 or 7 y'rs ago	20.50	13.25	10.00	21.00	13.00	12.00
S. Lee	Wentworth	"	pasture		9.56	9.50	12.50	10.69	9.06	8.75
S. Rankin	Perth	sandy loam	"	never	12.00	9.00	15.00	8.00	9.00	14.00
J. B. Rhodes	Kent	clay loam	potatoes	1893	12.50	16.50	11.50	8.00	24.00	13.00

XII. TESTING SIX VARIETIES OF OATS.—*Concluded.*

Experimenter.	County.	Nature of soil.	Cropping of 1894.	How and when last manured.	Yield of grain per plot.					
					Siberian.	Bavarian.	Joanette.	Oderbrucker.	Besthorne.	Poland White.
					lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Chas. Musclow	Hastings	sandy loam	wheat	1894	4.50	6.75	11.50	11.00	7.75	5.75
B. J. Palmer	Oxford	clay loam	turnips	b.y.m., 1894	5.00	4.00	14.00	5.00	6.50	3.50
A. J. Taylor	Middlesex	"	oats	never	12 25	14 00	12.00	12 00	12.50	13.50
C. W. Taylor	Perth	"	"	b.y.m., 1893	17.75	18.50	11.25	18.25	13.25	12 25
Jas. Petigrew	Bruce	clay	clover	no manure	15.00	14 00	18.00	15 00	14.00	18 00
J. J. Brady	Middlesex	clay loam	potatoes	never	14.00	16.00	12.00	17 00	13 00	18.00
H. Miller	York	swamp loam	peas	never	16.50	15 00	20 00	13 00	11 00	16.00
Jas Auld	Wellington	loam	oats	b.y.m., 1890	6.00	5.25	5.00	5 50	4 75	6.25
D. Taylor	Grey	sandy loam	potatoes	b.y.m., 1894	13.50	8.50	7.00	9 00	5.00	7.00
A. Ecker	Norfolk	"	wheat	b.y.m., 1894	23.00	19.00	17.00	20.00	20.00	18.00
I. Hansen	Haldimand	clay loam	oats	b.y.m.'94-'95	11 50	11.25	10.00	12.50	16 00	10.75
Jas. Andrews	Grey	light loam	"	v'ry little '94	13.00	13.00	13.50	11.00	10.50	12.50
J. Wooddisse	Wellington	sandy loam	peas	never	8.00	10 25	9.00	10.25	9.25	8 00
G. N. Gerow	Ontario	"	alsike	b.y.m , 1892	9.75	9.50	6.00	6 50	6.50	7.00
R. Lawrence	Halton	clay loam	millet	old pasture	9.13	8.80	9 38	9.13	9.00	9.38
J. W. Gillies	Brant	"	wheat	1893	9 50	6.00	12 00	10.50	6.50	10.00
A. Nichol	Middlesex	"	fall wheat	b.y.m., 1894	13.50	14.00	10.50	15.00	12 50	10 50
W. E. Gillies	Brant	clay	turnips	1894	20 00	11 00	15.00	15.00	19.00	22.00
Jas. Armstrong	Grey	sandy	potatoes	b.y.m., 1894	10 00	10.00	7.00	7.00	10.50	6 50
G. W. Beckett	Welland	clay	hay	b.y.m., 1891	10.00	9 00	10.00	8.00	6 00	10 40
Graham Bros	Middlesex	clay loam	peas	1894	13 00	16.00	16.00	12.00	14.00	12.00
R. Gray	Huron	"	fall wheat	1893	21.00	22.00	18.50	19 50	20.00	17.00
D. Madden	Bruce	"	bare fallow	b.y.m., 1894	18.00	14.50	16.00	15.00	15 50	15.50
Jas. Fell, Jr	Victoria	"	spring wheat	b.y.m., 1890	6.75	9.00	5.50	8.50	8.00	8 75
Jas. Howe	Elgin	gravelly	wheat	1893	9.00	9.50	9.00	9.00	8.00	10.00
J. T. Bayley	Muskoka	sand	clover	none	8.10	7.20	8.20	8.00	5.50	6.00
H. Dawson	Wellington	fair	oats	b.y m., 1895	7.25	11.50	13.00	7.75	11.00	11.50
A. Kennedy	Dundas	clay & grav'l	potatoes	b.y.m., 1894	5.00	8.00	3.00	9.00	6.00	6.00
J. L. Wilson	Lanark	sandy loam	peas	b.y.m., 1894	4.00	6.00	3.00	3.00	4.00	5.00
J. R. R. Secord	Lincoln	black loam	clover	none	8.88	7.38	7.00	9.13	9.31	8.31
J. W. Hartman	Grey	light, gr'v'lly loam	potatoes	[years not for sev'r'l	9.00	9.00	12.00	9.00	10.00	8.50
D. Reid	Halton	loam	barley	1893	8.50	7.00	6.00	10.00	8.00	9.00
Wm. Murray	Algoma	clay	potatoes	never	15.00	14 00	20.00	14.25	13.25	14.00
Jos. Fearon	Algoma	h'vy cl'y lo'm	new land	never	12.00	10.50	10.00	17.00	15.50	16.00
W. L. Montgomery	Stormont	loam	potatoes	1894	11 00	10.50	9.00	10 00	10.00	7.50
Wm. Goodger	Oxford		fall wheat	b.y.m., 1894	12.25	11.50	10.00	12.00	15 00	9.25
H. Coben	Peterboro'	sandy loam	peas	b.y.m., 1894	10.50	9.00	10.50	11.00	10.00	11.00
Thos. Sproule	Frontenac	bl'ck ground	barley	never	11.00	12.00	9.50	9 00	10.50	12.00
J. P. Rutherford	Algoma	clay loam	peas	1892	13.00	13 00	12.00	13.50	14.00	16.00
P. Rutherford	Algoma	"	"	1893	13.00	14.00	10.00	12 00	13 00	17.00
W. H. Helmer	Renfrew	loam	old land	1894	14.00	16.00	17.00	13 00	16 00	15.00
Jas. McMahan	Lambton	black clay	corn	never	26.00	25.75	23.00	23.50	24.00	25.50
J. F. Beam	Welland	black loam	oats	never	22.00	16.00	20.00	18.00	19.00	17.50
T. J. M. Skelly	Simcoe	clay	potatoes	1894	18 00	16.00	21.00	18.00	15.00	23.00
Wm. Lamb	Bruce	gravelly loam	pasture	b.y.m., 1892	9.00	9.00	7.00	9.50	9.00	9.50
W. H. Teeple	Elgin	cl'y & gr'v'lly loam	mangels	b.y.m., 1894	4.25	6.00	6.50	4.00	5.00	3.75
F. Sweet	North'mbl'd	st'ng cl'y l'm	fall wheat		6.00	8.50	8.75	5.00	7.50	11.00
J. Duncan	Wellington	clay loam	oats	1893	7.50	5.25	5.50	6.25	5.00	5.00
Chas. Hay	Frontenac	"	mangels	1894	21.25	12.50	20.00	11.00	17.50	16.00
T. W. Stephens	York	"	fall wheat	b.y.m., 1893	25.50	24.00	25.50	23 50	23.00	21 00
J. E. Hull	Middlesex	"	wheat	1893	16.00	12.00	13.00	17.00	20 00	15.00
H. Kelly	Waterloo	"	roots	1893	16.50	15 00	16.00	18.00	17.00	12 00
J. H. Best	Haldimand	black loam	corn	1893	12.00	11.00	6.00	14.00	10.00	10.00
Jno. Kelly	Grey	sandy loam	potatoes	1894	20.00	13.00	18.00	13.00	12.00	15.00
Joel Brenton	Hastings	clay loam	corn	none	4.00	4.00	4.25	2.75	3.25	2.50
J. J. Hall	Dufferin	sandy loam	roots	1893	16.00	19.00	17.00	16.00	16.50	11.00
Exp. Dept. O. A. C.	Wellington	clay loam			10.14	15.94	11.23	14.00	12.19	19.27
N. Dunbar	Bruce	sandy loam	oats	b.y.m., 1883	13.50	7.50	11.00	11.00	8.00	13.00

The Ontario Agricultural College imported the Siberian Oats from Russia, the Joanette from France, the Oderbrucker from Germany, the Besthorn from Germany, and the Poland White from France. The Bavarian is termed an Ontario oat, as it has been grown in this Province for about twelve years, and it was grown in New York State about six years previous to that. The Bavarian stands highest of all the Ontario oats that have been grown at the Ontario Agricultural College for seven years in succession.

Average results of 79 experiments :

Varieties.	Comparative value given by experimenters.	Yield per acre.	
		Straw.	Grain.
		tons.	bush.
Siberian	100	1.6	57.1
Bavarian	74	1 6	55.0
Joanette	82	1.4	54.9
Oderbucker	82	1.4	54 8
Besthorne	70	1.5	54.1
Poland White	77	1.4	53.9

CONCLUSIONS.

1. The Siberian which stands at the head of the list in average yield of grain per acre among seventy-eight experiments in 1895, also occupied first place in the average of 121 experiments in 1894, 105 in 1893, and 125 in 1892.

2 The Joanette which stands third in the list of 1895 occupied first place in the list of 1894, 1893, and also of 1892.

3. The Joanette is the shortest strawed variety of those tested in the co-operative experiments.

4. The Siberian variety of oats was the most popular among the experimenters in 1895, and the Besthorne was the least popular.

5. The Siberian gave an average of over two bushels per acre more than the next highest yielding variety. This amount of increase upon the area devoted to oats in Ontario in 1895, would make a difference of nearly five million bushels of oats in the Province in one year, simply through the increase of two bushels per acre.

XIII. FOUR LEADING VARIETIES OF PEAS.

INSTRUCTIONS.—Same as those given for spring wheat.

Average results of 69 experiments.

Varieties.	Comparative value given by experimenters.	Yield per acre.	
		Straw.	Grain.
		tons.	bus.
Egyptian Mummy	85	1.2	24.3
Prussian Blue	100	1.1	24.2
White Marrowfat	84	1.1	22.5
Canadian Beauty	99	1.1	21.1

The following table gives the individual results of 69 experiments :

Experimenter.	County.	Nature of soil.	Cropping 1894.	How and when last manured.	Yield of grain on plot			
					Egyptian Mummy.	Prussian Blue.	White Marvellous wfat.	Canadian Beauty.
					lbs.	lbs.	lbs.	lbs.
T. F. Howell	Brant				9 00	10.00	9.25	10.00
Geo. McKay	Bruce	heavy loam	fall wheat	6 yrs. ago	4.00	3.00	4 50	4.25
Jas. Pegg	Grey	sandy loam	potatoes	1893	2.50	3.13	4 00	3.50
Frank Doud	Brant	clay loam	wheat	clover, 1894.	10.75	10.00	9.00	9.75
Guildford Butler	Lambton	clay	barley	1895	10.00	12 00	12 00	11.00
Geo. Jackson	Huron	clay loam	oats	1893	4.00	10.00	4.00	6.00
Robt. Adams	Bruce	clay loam	oats	15 yrs. ago	22.00	24.00	15.00	20.00
P. M. Campbell	Lanark	sandy loam	turnips	b.y.m., 1893	10 00	9 00	8.00	10.50
E. A. Maddock	Simcoe	clay loam	spring wheat	never	10 50	11.00	11.00	10.00
Nicol Dawson	Northumberland	"	oats	1895	5.00	5 00	4.50	10 00
J. R. Maddock	Simcoe	"	spring wheat	never	10.50	11.00	11.00	10.00
Jas. Cruickshank	Kent	sand	corn	1895	6.00	7 00	5.00	8.75
J. B. Lindsay	Huron	clay	corn	b.y.m., 1894	14 00	10.00	7.50	7.00
Fred Swaine	Bruce	sandy loam	turnips	1894	7.50	10 00	7.00	7.00
Chas. Silverthorn	York	gravel	oats	never	3.00	7.50	5.50	3.25
Jos. R. Hamilton	Simcoe	clay loam	wheat	1893	8.00	7.00	12.00	11.50
Jno. F. McCracken	Huron	heavy clay	turnips	b.y.m., 1894	8.00	6.00	4.50	8 00
J. S. Rumney	Victoria	loam		never	4.00	4.50	4.00	4.00
R. J. Deachman	Huron	clay loam	summer fallow	b.y.m., 1894	4.00	4 66	4.00	5.00
J. H. Weater	Welland	clay	potatoes	1894	9.50	8.75	9 50	11.25
J. W. Kernigham	Huron	clay loam	fall wheat	never	7.00	7.00	5.50	4.5.
Gordon Young	Huron	"	corn	1894	1.50	3 00	2 50	2.00
Henry J. Wary	Durham	light clay l'm	clover hay	1889	9.00	10 00	11.00	11.50
Jas. Robertson	Simcoe	clay loam	alsike	b.y.m., 1892	15.00	12.50	8.50	12.00
Thos. J. Lee	Simcoe	"	potatoes	b.y.m., 1894	2.00	3.75	4.00	8.00
David Graham	Hastings	"	peas		11.05	13.00	9.50	12.00
Jno. W. Jessop	Renfrew	sandy loam	oats	never	17.00	10.00	13.00	11.00
Nelson Monteith	Perth	clay loam	hay	b.y.m., 1892	13.50	12.00	8.00	13.00
Edmond Cook	Dufferin	sandy loam.	roots	1894	13.50	7.50	13.50	15.50
Jas. Alexander	Halton	clay loam	pasture	1891	9.00	9.00	8.50	6.50
Ed. Mans	Brant	sandy loam	strawberries	b.y.m., 1891	5.59	6.50	7.00	6.44
Robt. Waterson	Russell	"	peas	1894	4 38	5.88	3.44	4.63
Geo. Wright	Wellington	sandy loam	ensilage corn	b.y.m., 1894	16.00	15.00	13.00	12.00
J. H. Frarey	Algoma District	clay	peas	never	14.00	11.50	10.50	12.50
David Sinclair	Muskoka	sandy loam	beans	b.y.m., 1895	4.75	6.50	6.25	8 50
Jas. T. Bayley	Muskoka	sandy	fodder corn	b.y.m., 1895	11.50	17.50	15.75	7.00
E. P. Wilson	Norfolk	sandy loam	wheat	b.y.m., 1895	2.00	3.00	2.50	3.50
John Ramage	Russell	clay loam	meadow	b.y.m., 1894	15.00	11.50	10.50	11 00
W. M. Leigh	Perth	"	fall wheat	b.y.m., 1894	10.00	13 50	11.50	14.00
Wesley Rose	Simcoe	sandy loam	barley	b.y.m., 1894	12.50	18.00	9 00	15.00
C. W. Neville	Lennox and Ad	"	meadow	b.y.m., 1895	4.50	3.50	3.00	4.00
J. I. Graham	Grey	loam	sod	never	7.00	10.00	8 00	7.50
T. C. Wheatley	Lambton	mucky	corn	none	14.50	8.00	12.00	14.00
Jas. Pate	Brant	sandy loam	oats	1892	4.25	7.00	2.25	3 00
Jas. Allen	Simcoe	clay loam	fall wheat	b.y.m., 1894	8.75	12.00	9.00	10.25
J. L. Wilson	Lanark	sandy loam	peas	b.y.m., 1894	5.00	2.00	4.00	3.00
Robt. Gray	Huron	clay loam	fall wheat	1893	13 00	17.00	15.00	17.50
Thos. Robertson	Victoria	light			3.19	2.06	4.13	3.38
Jas. Fell	"	clay loam	spring wheat	b.y.m, 1890	2.50	3 00	2.75	3.50
John Currie	Huron	light clay l'm	peas	spring, 1894	9.00	10.50	9.00	10.00
Ralph Tiplady	"	clay loam	oats	b.y.m., 1892	14.25	10.00	15 00	11.00
John D. Scott	Oxford	"	pasture	b.y.m., 1890	12.38	11.19	12.25	11.81
Geo. F. Laxton	Ontario	sandy loam	hay	never	7.75	5.63	4.25	8.50
W. R. West	Nipissing	clay muck	potatoes	virgin soil,	12.50	13.25	15 50	14.00
Jas. H. Newlove	Peel	clay loam	clover	b.y.m., 1892	10.00	9.50	12.00	7.50
A. G. McIntosh	Bruce	sandy loam	carrots	b.y.m., 1894	15.00	10.50	10.25	11.00
Jas. McCallum	Perth	clay loam	fall wheat	1893	7.50	7.00	5.50	8.50
J. F. Beam	Welland	black loam	oats	never	11.25	8.50	9 00	12.00
Abram Schooley	East Elgin	sandy loam	fall wheat	1893	6.00	8.00	8.00	6.00
John Richardson	Dufferin	clay loam	oats	b.y.m	9.13	8.50	6.75	10.38
S. Parkinson	Huron	"	corn, 3 years	b.y.m., fall,	5.00	11.00	13.00	16.00
David Thompson	Wellington	"	pasture	b.y.m., 1888	15.00	11.00	12.00	8.00
Richard Moore	Frontenac	clay	hay	b.y.m., 1890	10.50	6.00	8.00	10.00
R. R. Sangster	Glengarry	clay loam	sod	b.y.m., 1888	12.00	10.00	8.00	16.00
Henry Kelly	Waterloo	clay & bl'k m'k	barley	1892	9.00	10.50	10.00	13.00
John Kelly	Dufferin	sandy loam	potatoes	1895	9.00	9.00	7.00	10.00
Adam Esplen	Bruce	"	roots	1894	2.50	3.00	4.50	3.75
C. M. Macfie	Middlesex	"	potatoes	b.y.m., 1895	4.00	7.00	4 00	7.00
Experimental Dep't.	Wellington	clay loam			12.91	10.75	10.41	11.09

Conclusions.

1. The Prussian Blue variety of peas gave the largest yield of grain per acre of seventy-three co-operative experiments in 1893 ; and of sixty-three co-operative experiments in 1894 ; and, along with the Mummy, of seventy-two experiments in 1895.

2. The Prussian Blue was the most popular variety tested by the experimenters in 1895, and the Canadian Beauty was the next most popular variety.

3. There is a great demand in Ontario for a good variety of peas.

XIV. TESTING SIX VARIETIES OF POTATOES.

(1) Prepare for planting *all* the potatoes received upon *uniform* plots made to an *exact size.*

(2) First count the potatoes and then cut them in such a way that there will be exactly sixty-six pieces of each variety.

(3) One row sixty-six feet (four rods) long is required for each kind. If the rows are placed side by side a distance of thirty inches should be allowed between the rows.

(4) Drop the pieces one foot apart in the row, and aim to have the pototoes placed four inches below the surface of the ground.

(5) Each variety should be marked with a good substantial label made out of wood.

(6) Flat cultivation thoroughly done is recommended.

Previous to the year 1894 the work of the horticultural committee was devoted to the testing of varieties of potatoes. As the committee of agricultural experiments was in a much better position to take charge of this work, and as it was the desire of the director of the horticultural committee to carry on tests with small varieties of fruits, the experiments on potatoes were transferred from the horticultural committee to the committee on agricultural experiments.

Average results of 49 experiments.

Varieties.	Table quality. 100=best.	Percentage crop marketable.	Average yield per acre, bush.
Empire State	94	93	205.1
Freeman	87	91	204.7
American Wonder	79	92	196.0
Pearl of Savoy	87	93	189.4
Summit	86	91	181.3
Burpee's Extra Early	100	88	165.6

Conclusions.

1. The Empire State gave the largest average yield of potatoes per acre in fifty-two co-operative experiments in 1895, and in thirty-eight co-operative experiments in 1894, as well as among twenty-three varieties of potatoes grown at the Agricultural College for six years in succession.

2. From the reports giving the weight of the thirty largest potatoes of each variety in the individual experiments, it is found that the Empire State and the Pearl of Savoy produced the largest sized potatoes, and the Burpee's Extra Early the smallest.

3. In table quality the majority of the experimenters mentioned the Burpee's Extra Early and the Empire State as being the best, and the American Wonder as being the poorest.

4. The Burpee's Extra Early was the earliest variety to reach maturity of the six kinds under experiment.

5. The Empire State and the Pearl of Savoy possessed the largest per cent. of marketable potatoes, and the Burpee's Extra Early the smallest per cent.

6. There was a difference of about forty bushels per acre between the average yield per acre of the Empire State and the Burpee's Extra Early.

Individual results of 49 experimonts with potatoes.

Experimenter.	County.	Nature of soil.	Cropping of 1894.	How and when last manured.	Yield of potatoes per plot					
					Empire State.	Freeman.	American Wonder.	Pearl of Savoy.	Summit.	Burpee's Extra Early.
					lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
John Dawson....	Algoma	sandy loam	turnips	.....	1 14	68	114	71	73	106
Ed. Allen.....	Simcoe.....	" "	oats.....	never	69.5	72	78	67	73	50
F. A. Whetter..	Victoria. ..	clay loam..	oats.....	1895.....	84	97	92	85	79	58
A. Duncan.....	Russell.....	gravel.....	potatoes....	1894.....	66	79	63	75	71	70
D. V. Purvis....	Leeds.....	loam with clay bottom	potatoes...	artificial manure, 1894	79.8	87.5	68	73.8	48	50.8
Jas. Branch.....	Durham, W.	sandy loam grvl. bottom	onions.....	1895.....	85.5	73.8	77	82.3	69	65
Jas. Brodie.....	Grey	clay loam ..	....	never	57	60	42	56	50	56
Joseph Osborne..	Lambton ..	strong clay.	peas.....	.....	159	117	130	110.3	95.3	71
Jno. R. Suddaby.	Wellington.	good s. loam	fall wheat ..	b. y. m. 1984	71	91	64	100	64	55
A. S. Yarwood..	Pr. Edward	rich loam ..	oats.....	b. y. m. 1893	72.3	65.5	70.6	74.8	68.2	67
H. H. Kottmeier.	Welland....	black loam..	.....	b. y. m. 1894	50	45	48	38	50	45
E. C. DeGuerre..	York	clay.....	mangels	1894.....	44	56	61	55	49	53
T. Black Laws..	Lambton ..	sandy loam	hay	... .	40	61	31	39	37	52
Chas. King.....	Oxford	clay loam..	oats.....	.....	76	91	72	84	86	78
Jno. Allen.....	Grey..	sandy loam	corn.....	....	43	35	51	45	38	38
Walter Hartman	Grey.....	clay loam .	peas..... ..	b. y. m. 1895	63	51.3	47	48	47.5	41
J. M. Fair.....	Frontenac..	sandy	potatoes....	b. y. m.	56	51	52	55	50	42
J. A. Davidson...	Peterboro ..	clay loam ..	hay	.....	24	18	17.5	20	19	24
A. Zimmerman..	Welland....	muck	potatoes....	never	51	39.5	37.5	21	28	24.8
John Oxendale..	York	clay loam .	oats.....	1894.....	84	73	65	68	47	29
Adam Douglas..	Victoria....	sandy loam	.....	1894.....	122.5	128.5	126	84	152	103.5
H. C. Garbutt..	Peterboro'..	" "	potatoes....	....	67	62	72	67	67	67.5
Fred B. Hutt....	Welland....	" "	onions.....	b. y. m. 1894	82	64	49	62	61.5	71
Jas. S. Miller....	Parry Sound	clay loam..	corn.....	b. y. m. 1894	74	90	76	80	70	70
Geo. North.....	Wellington.	" " ..	oats.....	1895	32	49.5	26	50	51	34.2
B. A. Johnston.	Stormont ..	sandy loam	corn, 1894 ..	.....	132	153	137	163	113	164
Nathaniel White	Grenville ..	.....	pasture	.....	46 7	33	43	18	27.5	26.7
John Sinclair....	Ontario	sandy loam	oats.....	fall, 1894...	38.5	55	40	44 5	36.5	36
Simpson Rennie.	York	black c. loam	oats.....	1895..	124	134.5	94	103	92.5	89.5
Wm. Wills.....	York	sandy loam	potatoes....	1894.....	62	90	82	68.5	58	53.1
J. Blackburn....	Simcoe	clay.....	peas.....	.....	47.5	53.5	46	48	33.2	36.5
J. F. Davis.....	Peterboro'..	sand loam..	mangels	b. y. m. 1895	59.5	77	52	57.5	49	46
Ira F. Pearce....	Durham....	clay...	mangels	b. y. m. 1895	48	65	97	81	65	52
Jas. More.....	Perth	clay loam..	potatoes....	b. y. m. 1895	72	62	66	73	85	56
W. R. Vrowman	Oxford	" " ..	corn.....	b. y. m. 1895	82	74	66	68	62	52
Thos. F. James..	Ontario	s'ndy c. loam	oats.....	.....	80	68	75	71	66	68
J. N. Wiley....	Peel	sandy loam	oats.....	1894.....	54	60	55	57	51	50
Thos. Barber....	Hastings ..	clay loam..	turnips	1894.....	92	121	106	133	139	90
R. A. Thompson	Simcoe	" " ..	hay	.....	73	84	77	80	71	80
H. Storey.....	Pr. Edward	loam	corn.... ...	b. y. m. 1894	57	72	57	37	61	35
Moses Kraft.....	Waterloo ..	limest'ne gvl	melons	1894.....	159	126	120	96	104	121
J. E. Hull	Apoin.....	new gvl loam	corn.....	....	152	78	116	147	163	57
R. R. Sangster..	Glengarry ..	red loam....	peas.....	b. y. m. 1887	64	50	85	54	37	60
W. C. McGregor	Kent	clay "	potatoes....	.....	38	34	37	37	32	38
Geo. Short	Wellington	" "	alsike clover	1895.....	55	73	68	53	52	61
Arch. McColl...	Elgin	" "	....	.....	160	160	105	140	95	80
W. T. Prangley..	Kent	" "	first crop ..	never	68	63	160	75	75	63
A. E. Smith....	Wentworth	sandy loam	potatoes....	never	58	77	67	54	68	43
J. H. Elliott	Hastings...	clay loam ..	peas.....	1895.....	125	122	105	133	126	110

XV. TESTING FIVE LEADING VARIETIES OF WINTER WHEAT.

(1) Select a portion of uniform soil and mark off five plots, each one rod square. Allow a path three feet wide between each two consecutive plots.

(2) Drive stakes at the four corners of each plot.

(3) Sow the different varieties upon their respective plots. It is an advantage to run a streng cord around each plot and sow inside the line.

(4) After the grain is up three or four inches, again run the cord around each plot and cut off any plants that happen to be outside the line.

Individual results of 100 experiments.

Experimenter.	County.	Nature of soil.	Cropping, 1894.	Weight of grain on plot.				
				Lawson's Golden Chaff.	American Bronze.	Jones' Winter Fife.	Surprise.	Early Red Clawson.
				lbs.	lbs.	lbs.	lbs.	lbs.
G. M. Cary	Middlesex	clay loam	bare fallow	11.0	8 0	11.0	10 0	11.0
E. A. Maddock	Simcoe	clay	peas	16 0	13.0	15.0	14.0	15.0
Mrs. J. W. Todd	Simcoe	clay loam	peas	16.0	13.0	15.0	14.0	15.0
R. Robertson	Northumberland	sandy loam	peas	12 0	7 0	6.5	8.0	7.0
W. Fotheringham	Huron	clay loam	bare fallow	9.5	6 7	6.2	5 0	9.2
W. W. Russell	Simcoe	clay loam	potatoes	17.2	10 2	13 2	11.7	17.0
Jas. Linlsay	Grenville	gravelly	cats	15 0	13 0	17 0	14.0	12 0
G. S. Duncan	Haldimand	clay		8.0	7 0	8 7	8 0	7.0
Jno F. Andrew	Huron	gravelly loam	bare fallow	8.5	6.5	4.0	9.0	6 0
D. A. Moss	Elgin	clay loam	potatoes	11.2	9.2	9 5	9.7	6.2
J. W. Brown	Elgin	free clay	wheat	12.0	9.7	10.7	10 0	10.0
Thos. Thompson	Peterboro'	clay loam	bare fallow	12.8	10.1	9.0	12.0	11.7
D. D. Springstead	Lincoln		oats	7.0	6.0	5 0	6.0	4.0
Wm. Lamb	Bruce	gravelly loam	wheat	11.0	13.0	9.0	7 0	11.0
T. G. Page	Halton	clay loam	bare fallow	4 0	3 0	4 0	4.0	3.5
Thos. Ferguson	Bruce	clay	hay	8.0	5.5	5 0	7.0	4.0
Wm. McMaster	Simcoe	clay loam	oats	20 0	16 5	12 2	9.2	18.7
O Mosser	Wellington	clay loam	peas	16.0	15.0	15.8	14 5	14.2
J R. Maddock	Simcoe	clay	peas	15 0	13 0	15.0	14.0	15.0
Jas. B. Muir	Bruce	clay loam	peas	12.0	14.5	14.0	10 0	13.0
Jno. Kehoe	Peel	clay loam	fallow	7 5	4.7	5.2	7.5	5.7
J. W. Hugill	Victoria	clay loam	peas	10.0	6 0	6.0	9.5	9.0
Jno. Dalgarno	Grey	clay loam	corn	11.5	11.0	10.0	9.0	11.0
N. Dawson	Northumberland	clay	clover pasture	7 5	8.0	7.0	6.0	7.0
A. Magee	Lennox	sandy loam	beans	14 0	15.0	8 0	13.0	9.0
E. Armbrust	Welland	sandy loam	hay	3.7	4 0	1.7	3.0	1.5
P. C. Blackburn	Kent	sandy loam	corn	10.0	6.2	9.5	9 5	9.5
T. E. Cragg	Ontario	loam	potatoes	11.0	7.5	9 5	8.5	8.2
Geo Roberts	Bruce	light		10.5	7 5	9 0	6.0	7.0
F. Somerton	Lanark	heavy clay	clover	20.0	17.5	21 0	19 0	15.0
Jas. Stewart	Oxford			10 4	9.0	10 0	8.3	8.3
H. Mosser	Wellington	clay loam	roots	15 2	14 5	14.5	14.0	13.8
Jno. Mosser	Wellington	clay	none	15.0	14 0	16.5	14 5	14.0
T. Stephenson	Grey	sandy loam	potatoes	12 2	13.7	11.5	11.2	11.7
R. McLaren	Huron		barley	15.0	12.5	13 0	12.0	13.0
P. H. McCall	Lambton	clay	oats	6.7	5 0	6.0	6.5	5 5
R. Cummings	Bruce	clay	peas	19.0	22 0	17.5	20.0	20.0
H. Mackey	Peterboro'	clay loam	bare fallow	14.5	12.5	15 0	15.5	19.5
I. H. Turner	Grey	clay	peas	8.2	4.0	12.2	7.5	7.2
J. White	Kent	clay	oats	14 0	10 0	11.0	11 0	13.0
Thos Henry	Kent	clay loam	potatoes	9 5	6 0	7.5	8.0	6.0
Jno. Priddle	Norfolk	sandy	peas	5 0	7.0	6 0	5 0	7.0
Jas. Tesky	Addington	clay loam	oats	10.0	10 5	9 5	8.0	11.0
D. Oram	Hastings	sandy loam	potatoes	7 0	8 2	5 0	6 5	8 0
J. A. Frame	Bruce	clay	bare fallow	8 7	10.0	8.5	8 0	8.0
A. H. Jacobs	Huron	clay loam	strawberries	16.0	11.0	7.0	9 0	11.0

Individual result of 100 experiments.—*Continued.*

Experimenter.	County.	Nature of soil.	Cropping, 1894.	Weight of grain on plot.											
				Dawson's Golden Chaff.		Pride of Genesee.		Early ripe.		Early Genesee Giant.		Early White Leader.	
				lbs.		lbs.		lbs		lbs.		lbs.	
Wm. Hollingreen	Halton	clay loam	potatoes	12	5	13	0	12	5	14	0	11	0
Wm. McNab	Middlesex	clay	bare fallow	14	0	11	5	11	5	12	5	14	0
Wm. C. Wilson	Simcoe	clay loam	bare fallow	10	0	8	9	6	6	7	6	9	7
Jno. Phillips	Huron	sandy	peas	8	0	7	0	6	0	10	0	11	0
Jas. Wiley	Lambton	sandy loam	potatoes	16	0	10	0	13	0	15	0	8	0
W. S Fraser	York	clay loam	bare fallow	15	0	14	0	14	5	12	6	12	0
N. Wiley	Lambton	gravelly loam	potatoes	15	0	10	0	13	5	14	5	9	0
S. Moore	Peel	heavy clay	timothy	11	0	9	5	7	5	11	5	11	5
T. W. Klinch	York	black clay loam	spring wheat	23	5	22	5	20	5	26	0	20	5
Thos. Wheatley	Grey	clay loam	peas	6	0	1	5	1	0	5	0	2	0
D. McVannel	Perth	clay loam	peas	18	0	18	0	12	0	16	0	14	0
Chas Krueger	Grey	light loam	potatoes	5	7	6	0	3	0	6	5	6	0
F. Somerton	Lanark	heavy clay	potatoes	20	0	22	0	16	0	21	0	15	0
Jno. Barron	Norfolk	clay	corn	11	2	7	0	6	2	14	0	11	5
C. Ketchaban	Elgin	light sand	fodder corn	9	0	5	5	6	5	7	5	6	5
C. C Ford	Elgin	black loam	pasture	8	5	7	0	9	0	7	0	6	7
H. G. Nisbet	Peterboro'		peas	7	0	5	5	5	5	8	0	5	0
Jno. A. Hankinson	Elgin	clay loam	peas	19	0	12	0	20	0	14	0	18	0
Jno. Leonard	Elgin	clay loam	corn	22	0	17	0	17	0	15	0	16	0
R. Gray	Huron	sandy loam	hay	8	0	5	5	5	5	6	5	5	0
M. Buchanan	Middlesex	clay loam	bare fallow	18	0	17	0	16	0	15	0	16	0
Hamill Bros	Victoria	clay loam	alsike clover	8	5	7	0	8	5	11	0	6	0
A. Pickett	Halton	loam	fall wheat	10	0	9	0	9	5	10	0	8	0
Jno. L Hugill	Victoria	heavy clay loam	peas	9	0	10	0	6	5	8	0	7	0
H. Salmon	Wentworth	heavy clay	bare fallow	5	0	6	5	6	0	6	0	5	5
Geo. Brent	Lambton	clay loam	potatoes	21	0	16	5	18	0	24	7	17	0
Jas. McLaren	Middlesex	sandy	peas	8	0	5	5	3	0	5	5	5	0
O. Vansickle	Wentworth	clay loam	potatoes	6	0	9	0	8	5	3	0	4	0
Jas. Woods	Huron	clay	bare fallow	10	0	10	0	9	0	7	0	10	0
Jno. D. Neilson	Lambton	loam	bare fallow	11	0	3	5	4	5	8	0	5	0
R. B. Fitzgerald	Haldimand	clay	bare fallow	7	7	7	6	6	5	8	0	6	5
Jas. Smith	Lambton	sandy loam	oats	15	6	13	0	14	0	12	0	13	0
W. R. Wa ker	Halton	clay	bare fallow	16	0	12	0	12	0	13	0	11	0
D. H. McCallum	Middlesex	clay	bare fallow	13	0	12	0	13	0	10	0	12	0
W. H. Locke	Northumberland	clay loam	peas	8	7	9	5	9	9	6	2	7	0
Wm. Ireland	Middlesex	clay	bare fallow	7	5	6	0	7	5	7	0	4	0
Jas. Orr	Lambton	clay loam	corn	11	0	15	0	14	0	17	0	15	0
Wm E. Saddler	Middlesex	strong clay	potatoes	17	0	13	5	14	0	18	0	13	5
W. Hartman	Grey	clay loam	peas	7	5	6	5	7	7	4	7	8	5
D Stewart	Oxford			10	1	9	0	5	0	7	8	7	0
R. Richardson	Lambton	clay loam	wheat	15	0	12	0	14	0	16	0	13	0
W. H. Turnbull	Huron	sandy loam	peas	13	0	14	0	13	0	16	0	14	5
A. Reeve	York	gravelly loam	peas	5	5	4	0	3	0	3	2	3	1
G. W. Beckett	Welland	clay loam	oats	8	5	12	2	6	0	9	0	6	2
W. J. Coleman	Dufferin	clay loam	bare fallow	8	0	7	1	3	1	8	5	7	7
D. E. Charlesworth	Durham	clay loam	beans	8	0	6	0	1	5	3	2	4	4
S. Peter	Perth	sandy loam	peas	12	0	10	0	13	0	11	0	11	0
C. Horsburg	Northumberland	sandy loam	pasture	5	0	4	0	3	0	3	5	3	0
E. D. Plato	Welland	clay loam	peas	7	0	3	0	7	0	4	5	5	0
Jno. Morken	Middlesex	sandy	peas	14	0	15	0	16	0	17	0	20	0
D. Marshall	Grey	clay loam	corn	13	0	12	5	7	0	9	0	9	0
A. C. Park	Lambton	clay loam	peas	8	0	7	0	15	0	8	0	6	0
S. C. Smale	Lambton		potatoes	13	5	12	7	12	0	15	5	12	5
Geo. Sebben	Oxford	clay loam	barley	8	0	10	5	7	5	7	0	8	5

One hundred and twenty-two varieties of winter wheat have been tested at the Ontario Agricultural College within the past six years. Some of the varieties have produced yields of grain which were more than double those of other varieties grown beside them on plots of the same area Not only has there been a great variation in the comparative yields of grain produced by the different varieties, but there has also been a

marked difference in strength of straw, weight of grain per measured bushel, value of grain for milling purposes, etc, of the different varieties tested. The results of these experiments are published annually in bulletin form and in the College report, and are sent free to all members of Farmers' Institutes and others in Ontario by the Department of Agriculture, Toronto.

In the fall of 1894, nine leading varieties of winter wheat were selected from the kinds which had been grown from one to five years at the Agricultural College, and were distributed throughout Ontario for co-operative experimental work These were divided into two sets, with five varieties in each, the Dawson's Golden Chaff being used in both sets to form a basis by which the results of all the varieties could be compared with one another. Each person wanting to conduct an experiment, stated in his application which set he desired, and the five varieties in the set selected were sent to his address with full instructions for conducting the experiment. The grain was sown at the rate of $1\frac{1}{3}$ bushels per acre upon plots 1-160th of an acre in size.

Two hundred and forty-seven winter wheat experimenters have reported already this season. Of this number, one hundred favored us with good reports of successful experiments, eighty furnished partial reports, and sixty-seven wrote of failure or unreliable results. The names of the successful experimenters and the detailed results of the test will be printed in the annual report of the Experimental Union for 1895, which will be published as an appendix to the Agricultural College report

The following table gives the comparative yields of straw and grain per acre of the winter wheat varieties tested during the past season on one hundred Ontario farms :

	Straw per acre. (Tons.)	Grain per acre. (Bush. 60 lbs.)
1. Dawson's Golden Chaff	1.39	32 9
2. Early Genesee Giant	1.44	30 8
3. Early Red Clawson	1.23	28.9
4. Jones' Winter Fife	1 33	28 8
5. Pride of Genesee	1.33	28 8
6 American Bronze	1.34	28.6
7. Surprise	1 33	28.1
8. Early Ripe	1.36	27 8
9. Early White Leader	1 29	27.4

As none except the one hundred good reports of successfully conducted experiments have been used in the preceding summary of results, they should be of great value and worthy of the thoughtful attention of wheat growers in Ontario. Much credit is due to the careful experimenters who sent us the full reports, which have been used in this summary.

Concise Results of These Co-operative Winter Wheat Experiment

1. Reports of successful experiments with winter wheat have been received this season from thirty counties in Ontario, nineteen of which are east and eleven west of the city of Guelph.

2. The counties of Lambton, Middlesex, Huron, Grey, Elgin, Simcoe and Bruce, furnished fifty one of the one hundred good reports received in 1895.

3. Of the two hundred and fifty-seven experimenters who reported the results of their tests, only eight speak of wishing to discontinue the co-operative experimental work, and much interest is manifested throughout.

4. Dawson's Golden Chaff, Early Genesee Giant, Early Red Clawson, and Jones' Winter Fife gave the highest yields of grain among nine leading varieties of winter wheat tested throughout Ontario for two years in succession.

5. In average field of winter wheat per acre, Dawson's Golden Chaff stood highest among eleven varieties tested over Ontario in 1893, nine varieties in 1894, and nine varieties in 1895, also among fifty-three varieties grown at the Ontario Agricultural College for four years in succession.

6. In the co-operative experiments for 1895, Dawson's Golden Chaff, Jones' Winter Fife, and the Early Genesee Giant gave the best yields on heavy soils; and Dawson's Golden Chaff, the Early Genesee Giant, and the American Bronze on light soils.

7. When the experiments followed peas, grass, or bare-fallow, Dawson's Golden Chaff gave the largest average yield of grain, and when they followed potatoes, Early Genesee Giant came first in this respect.

8. Early Genesee Giant and Dawson's Golden Chaff made the best appearance in the spring of 1895, and Early Ripe looked the poorest.

9. American Bronze, Early Genesee Giant, and Dawson's Golden Chaff possessed the stiffest straw.

10. Pride of Genesee and American Bronze produced the greatest length of straw, and the Surprise the shortest length.

11. Early Ripe and Dawson's Golden Chaff were the least, and Early Genesee Giant and Early White Leader were the most affected by rust.

12. Early Ripe and Early Red Clawson were the first to mature, and the Pride of Genesee and Early White Leader were the last to mature.

13. Early Genesee Giant and Dawson's Golden Chaff produced the plumpest grain, and Early Ripe and American Bronze the most shrunken grain.

14. Dawson's Golden Chaff was decidedly the most popular variety with the experimenters in each of the past three years; and during the present season it was chosen by over sixty per cent. of the farmers who sent in full reports, as being the *best* among the varieties tested.

The results of the co-operative experiments for 1895 were all worked out on large charts of which there were seventeen in number. These were used at the meeting, and they seemed to be much appreciated by those in attendance. It seems as though as valuable a report as this should receive fully a half day for presenting and discussing. During the two and a half hours in which Mr. Zavitz was presenting it at the meeting the questions asked him were very numerous and many valuable points were brought out. The discussion is not herein given, as many of the questions are already answered, owing to the results being given in this report in more detail than could possibly be done at the meeting.

SMALL SIZE FACTORY CHEESE FOR HOME USE.

By J. F. Beam, Black Creek, Ont.

I propose, in this paper, to briefly state some of my own experience in supplying cheese to the local trade, and the possibilities attainable in properly cultivating the home market. I think I can best do so by giving a brief history of how I came to make small size factory cheese for home use. About five years ago I heard a lecture by President Mills, of the O. A. C., at a farmer's institute meeting in Welland. The lecturer showed the advantages of dairy farming for refertilizing the land, especially in the older sections where long-continued grain cropping had so impoverished it that the annual yield of grain had fallen below a paying basis. As a result of that lecture I started a cheese factory on my farm the following spring. In procuring vats and presses I obtained also a few small sized hoops for pressing small cheese. When making a number of full size cheese per day, of sixty to seventy pounds each, the daily remnant or pieces of curd were pressed in one or more of these small hoops. Thus quite a number of these little cheese

were made in the course of the season. We also made a number of flats or twins about four to six inches thick. The local demand for cheese was good at the adjacent villages and towns of the Niagara frontier. The price obtained per single seventy pound cheese delivered, was about one cent per pound more than when shipping by wholesale. But from the first I could not supply the demand for the small size cheese ten inches in diameter and weighing from twelve to twenty pounds each and flats made in regular large size fourteen-inch hoop that would weigh about twenty-five to thirty-five pounds. The latter was much preferred by certain grocerymen, because in cutting, there was not only less waste, but a neater and more convenient parcel could be made for customers to carry home, besides being less likely, than a full size cheese, to remain on the counter to lose flavor by drying out. Of course others who cut up a large cheese in one or two days, preferred the full size. My sixty-five factory patrons who supplied milk from one up to eighteen cows,—mostly from a few cows each—nearly all made earnest request for the small size cheese for their own home use and that of their neighbors. We made some by special order of ten pounds and under. The more the small cheese went out from the factory the stronger came the demand for them from patrons of the factory and other farmers, and also from townspeople. The cheese-maker in charge, although most obliging to meet the demand of the patrons of the factory, was not at first favorable to this outside demand for small cheese, and for a good reason, as it took just about as much time and labor to press, bandage and handle in the curing room a seven to ten or fifteen pound cheese as a seventy pound one. The extra cost, although slight, was an item to take into consideration. To those who desired to buy a small cheese I would say "I can cut you a piece just the size you like from one to ten pounds more or less, from a large cheese." The almost invariable reply was to the effect that a piece of cheese, cut in that way (from a large cheese) has so much exposed surface that it will dry out, crack and become leathery, tough, hard and unpalatable before we can use it all, and that there is more or less wasted, but with a small cheese it is not so much the case and we can take it home and cut it when we like. After having the matter brought to my attention in this way, so urgently, for a season or two, I decided to try and supply this demand for small cheese. I procured a number of small hoops for the purpose. Such hoops as I used can be made of galvanized iron, by any good careful tinsmith, and should be six or eight inches in diameter, and eight to twelve inches deep But they must be made very true to work well. In such hoops you can make cheese of three, five, seven or ten pounds each, as desired. Bandage and make them in every way the same as the large cheese. Press four of eight inches in diameter and seven of six inches on an upright press in the same space you would press one full size cheese. The best method of cutting such long, round-shaped cheese, is to cut it in two pieces near one end ; then slice enough for the meal, like off a large Bologna sausage or round loaf of bread. Place the two pieces together with the larger or heavier piece on top. Keep the cheese on or near the cool, dry ground floor of the cellar, and you can always have fresh cut, palatable cheese for every meal. The head-cloths and all bandages must be left upon the cheese to help retain the moisture until the cheese is used up. The best curd should always be taken for such small cheese. Gaseous curds and poorly made cheese will soon ruin the reputation and sale of such cheese (or in fact of any cheese.) Many prefer a soft, moist cheese. By salting lightly and using an extra quantity of rennet, and hastening the curd into the press, more moisture will be retained and greater profit realized. But this must be limited so that the quality is not injured. Cheese made in this way will cure rapidly and be ready for use for a certain portion of the trade within two to three weeks. By taking a number of such small cheese to the nearest market, or driving to every farmhouse in the vicinity, I found that good prices and quick returns could be realized. Every small cheese should be properly weighed, always giving good down weight,—and having weight and price plainly marked on every cheese with blue pencil which is best. In 1894, I realized twelve cents per pound for all small cheese and cut cheese at the factory to others than patrons sending milk, selling the bulk of my product in the local market. Say the wholesale price that year averaged nine cents per pound, and twelve cents could be realized for an output of twenty tons in the local market. The Niagara district alone consume several times that amount. This extra three cents on that amount means $1,200 extra income, paying

well for extra cost in making and marketing. People who said they seldom bought cut cheese at the store, would buy the small cheese when put up in a form to suit them and brought right to their doors. Some families I furnished have averaged as high as forty pounds per month. I sold the small cheese at the same price as grocerymen sold cut cheese, generally twelve cents in the summer time. We handled all small cheese in the local markets without the expense of boxing. But of course, such cheese can also be boxed and shipped to distant markets. We did not undertake to make what is known to the trade as "small fancy cheese" in various odd shapes, names and forms, to be sold only at fancy prices to a few epicures. But my idea is to put up cheese in a form and at a price to suit the million. I believe there is a special demand in our own home market which can be best supplied by putting up the cheese in an inexpensive, convenient form, similar to that which I have described. Many factories throughout the land, may, in this way, increase their incomes, by adding a small cheese department. Farmers, with good sized herds, can make up their own milk product by this plan and dispose of it all in the local market, generally at a price consideraly above the regular export rate.

It is said that we export our best cheese and consume the poorest quality at home. This can be reversed by this plan of supplying the home market. If our country in so many respects outranks the rest of the world, and the farmers, especially of our own Province, are so much in advance, as a class, of those of any other state or country, as has been so fully demonstrated at recent World's Fairs, should they not be suppliep with the best the earth affords?

As we make the best cheese should we not put it up in the best form possible to suit home demands? Will not the consumption of cheese also increase as the fact becomes more generally known that a pound of good cheese contains nutritive value equal to two and a half pounds of meat. There are about one million families in our Dominion, estimating five persons to a family. If they could all be properly supplied with cheese in a form that they would like and appreciate, would not our home consumption of cheese be vastly increased? If it could be increased only two pounds per family per week, it means two million pounds more per week consumed. That for fifty-two weeks in the year is over a hundred million pounds, or about the amount of our whole present annual export, all consumed in our own country! Referring to the important part in a factory, which the cheese-maker controls, I may here state that we took a natural pride in the good reputation our cheese acquired. But while our expert cheese-maker was such an adept in detecting the least mote of defect in the neighboring patron's milk, it transpired, surprising as it may appear, that he had a good sized beam (or Miss Beam) in his own eye all the while, and who is now his life companion. I am pleased to state further that our cheese maker attended and took a course of study in the dairy department at the O. A. C. By his natural skill and diligence he received highest honours and came out at the head of a large class of students. He thus appears to have been discovered and promoted by this institution, being now cheese-maker and instructor here at the O. A. C. I must say I consider his appointment to that position a most worthy one, although the people of Willowdale factory at Black Creek, while regretting to loose his efficient services, are pleased at his promotion. I feel it proper to say this much as an encouragement to other young men to go and do likewise.

FEEDING SHEEP.

By John A. Craig, B.S.A., Professor of Animal Husbandry, Agricultural College, Madison, Wisconsin, U. S. A.

The kind words of your worthy President in introducing me to you, and the previous subject which has been discussed have called to my mind a fable which seems to apply in a way to my position before you at this time. A crow was perched on a tree with a piece of cheese in his mouth when a fox happened that way. Desiring to obtain the cheese, the fox began to study how he could outwit the crow and secure his end. Rely-

ing on his native wit he began to address the crow in the following words :—" Oh, crow, how beautiful are thine eyes, how brilliant the plumage of thy wings, how shapely are thy talons, but oh, what a misfortune it is, that such a beautiful bird should be lacking only a voice !" The crow, anxious to remove this one deficiency in his qualities, opened his mouth to caw, and down came the cheese. The previous speaker having the subject of cheese and the kind words of your President has made me think of this peculiar instance and if I can leave with you anything of the solid worth of cheese, I shall feel that I have done something.

To present the feeding of sheep to you in the clearest way, it will be best to consider the management of the flock during the different seasons of the year. Beginning in the fall, after the lambs are weaned, we turn our breeding ewes on the poorest field of pasture or grain stubble that we have. The aim at this time is to check the milk flow of the ewes as soon as possible. For two or three days the udders of the ewes are noticed and milked out so that they may not become inflamed. After this is accomplished the ewes are given whatever pasture is available without reference to its quality until breeding season approaches. They are then fed so as to improve. It is the general belief that if the ewes are in good condition during the breeding season they are likely to drop a larger number of lambs. The belief is quite common, and it is also thought that when the ewes are in fair flesh they will breed earlier than those that are thin. We have made observations bearing directly on the latter point in our flock, but have not been able to secure results which would bear out such an opinion. Our aim in getting ewes in good condition is chiefly supported by the fact that they will keep in better thrift throughout the winter if they begin the winter season in vigorous and hard condition. They suffer less from colds and any trouble that they are generally liable to escapes them if they are thrifty and hardy when winter arrives. If the pasturage is not good enough to keep the ewes in the condition we want them, we do not hesitate to feed some grain as soon as the ewes go into winter quarters. They are fed oats if their condition is not thoroughly satisfactory, but on going over them if they are found to be as fat as we wish for they are not fed any grain. I may say, however, that we have never been able, on the pasturage and other food that we have, to get our ewes fat enough to go into winter quarters without feeding them extra grain. We feed oats and usually find that half pound per head daily is sufficient. The oats are fed as long as they seem to be needed to maintain the ewes in such flesh as we want them. With the oats during the winter, clover hay or good corn fodder is mostly used as the coarse portion of the ration. We have experimented with different kinds of fodder, for maintaining breeding ewes, and have found that there is nothing that will compare with clover hay for keeping the sheep in the best condition, and the sheep are also very fond of it. Of the different kinds of clover hay the preference of the sheep seems to be for alsike as it is very fine and has a flavor which they relish. Good corn fodder ranks next to clover hay in point of cheapness and the degree to which the ewes relish it. Oat hay is a very satisfactory fodder, and is perhaps on the whole superior to good corn fodder. Next comes oat straw and finally timothy. There is a fodder which is quite common in Canada, which I would place next to clover hay, and that is pea straw. We aim to feed some succulent food to our ewes, especially after they have lambed. At this time we feed them quite liberally on silage and roots with the hope that it will encourage the flow of milk. With this same object in view, as soon as the ewes have lambed we begin to feed them bran and this is the only grain feed that they get after lambing. While the ewes are in the shed we continue to feed grain, and for a short while after they have been turned out to pasture and then the grain is withheld from them. We have experimented to find out whether it pays to feed ewes corn while they are on pasture or whether it is best to feed such grain as we have had to the lambs. We have found that the lambs on the ewes that were getting grain did not make any more gain than those that were suckling ewes that had no grain. Without giving the details I may say that it was a satisfactory proof to us that it paid us much better to feed the grain directly to the lambs and allow the ewes nothing but good pasturage. We found that the ewes would improve in condition when fed grain but they did not seem to give any more milk than those that were not given grain.

Periods.	Lot I. Grain since birth.				Lot II. Grain since weaning.				Lot III. Grain since fattening.			
	Weekly gain.	Total gain.	Extra cost.	Average weight and value.	Weekly gain.	Total gain.	Extra cost.	Average weight and value.	Weekly gain.	Total gain.	Extra cost.	Average weight and value.
	lbs.	lbs.	$ c.	lbs. $ c.	lbs.	lbs.	$ c.	lbs. $ c.	lbs.	lbs.	$ c.	lbs. $ c.
First Trial, 1891.												
First: 10 weeks— April 30 to July 9	4.48	44.8	18	63.5 @ 5 66 =3.59— 18 *Profit*, 3 41	.....	....	.....	.....	3.65	36.5	.....	55.8 @ 4 91 *Profit*, 2 73
Second: 19 weeks— July 9 to November 19	2.66	50.7	1 47	103.7 @ 4 81 =4.98— 1 65 *Profit*, 3 33	.....	....	.....	.....	1.86	29.9	.....	82.6 @ 3 81 *Profit*, 3 14
Third: 14 weeks— November 14 to February 25.	2.81	39.4	1 62	145.7 @ 6 35 =9.25— 3 27 *Profit*, 5 98	.....	....	.....	.....	2.95	4.14	1 62	125.7 @ 5 60 =7.03— 1 62 *Profit*, 5 41
Second trial, 1892.												
First: 12 weeks— April 27 to July 20	3.1	37.6	34	61.8 @ 5 66 =3.44— 34 *Profit*, 3 15	.....	....	.....	.....	2.7	33.5	.. ...	56.2 @ 4 91 *Profit*, 2 75
Second: 16 weeks— July 20 to November 9	2.1	34.0	1 13	99.8 @ 4 81 =4.80— 1 47 *Profit*, 3 33	.....	....	.... .	.....	1.6	26.3	.....	84.5 @ 3 81 *Profit*, 3 21
Third: 14 weeks— November 9 to February 15..	2.8	40.5	2 35	140.3 @ 6 35 =8.90— 3 82 *Profit*, 5 08	.....	.....	.... .	.....	2.9	41.	2 30	125.5 @ 5 60 =7.02— 2 30 *Profit*, 4 72
Third trial, 1893.												
First: 12 weeks— May 10 to August 2	3.4	40.9	47	78.2 @ 5 66 =1.42— 47 *Profit*, 3 95	2.8	33.6	.....	70.6 @ 4 91 *Profit*, 3 46	2.35	28.2	.....	6.51 @ 4 91 *Profit*, 3 19
Second: 14 weeks— August 2 to November 8	1.4	19.4	56	97.6 @ 4 81 =4.69— 1 03 *Profit*, 3 66	1.5	21.1	56	91.7 @ 4 00 =3.66 - 56 *Profit*, 3 10	.91	12.8	.....	77.9 @ 3 81 *Profit*, 2 96
Third: 12 weeks— November 8 to January 31 ..	3.08	37.0	1 79	134.6 @ 4 25 =5.72— 2 82 *Profit*, 2 40	2.7	32.9	1 74	124.6 @ 4 00 =4.98— 2 30 *Profit*, 2 68	3.	36.	1 60	113.9 @ 3 50 =3.98— 1 60 *Profit*, 2 38
Fourth trial, 1894.												
First: 14 weeks— May 11 to August 17	3.63	50.9	33	77 @ 5 75 =4.42— 33 *Profit*, 4 09	2.67	37.5	.....	63.1 @ 5 00 *Profit*, 3 15	2.67	37.5	.....	63.1 @ 5 00 *Profit*, 3 15
Second: 12 weeks— August 17 to November 9....	1.35	16.3	36	93.3 @ 5 00 =4.66— 69 *Profit*, 3 97	1.57	18.9	36	82. @ 4 00 =3.28— 36 *Profit*, 2 92	1.1	13.3	.....	77. @ 4 00 *Profit*, 3 08
Third: 14 weeks- November 9 to February 15..	3.17	44.4	2 55	137.7 @ 5 75 =7.91— 3 24 *Profit*, 4 67	2.97	41.7	2 37	123.7 @ 5 50 =6.80— 2 73 *Profit*, 4 57	2.8	39.2	2 07	116 2 @ 5 00 =5.81— 2 07 *Profit*, 3 74

Feeding Lambs for Market.

The first point which I wish to lay before you bears on the question whether it is advisable in feeding lambs for market to give them grain continuously from birth or wait until within the last three months to fatten them for market. The general practice of our farmers may be said to be the withholding grain from their lambs until fall or the beginning of winter, and then they are put in pens or yards and fed on a fattening ration for two or three months before going to market. We have thought that this practice was not the most profitable, and to determine whether it was or not we have experimented over a period of five years with lambs from time of birth until sold ten or twelve months later. The general plan of our experiments has been to take three lots of ewes with their lambs at foot and divide them as uniformly as possible in every particular. To the one lot we would give the lambs grain from the time of birth. The other lot would not get any grain before weaning, but as soon as weaned they would be put on a grain ration. The last or third lot would not have any grain before or after weaning but as soon as it was necessary to put them in the sheds, on the approach of winter, they were given a fattening ration. You will see that there were three different periods in these experiments. The first period covers the time before weaning, and during that time the lambs in lot one had grain, and both of the other lots had no grain. The second period extends over the time of weaning usually in July or August until the time of fattening began, generally in November. The third period, called the fattening period, extended from November until February as a rule, and during this third period it is to be remembered that all the lots of lambs were put on exactly the same ration and given a similar management as closely as it was possible to do so. We have conducted these experiments for four years, and have now almost completed the fifth year. I should say in regard to the management of lambs that no difference whatever was made in their management except in the single particular that some lots had grain and the others had no grain at different periods. The chart which I have prepared here will make clear the exact difference in the profits from these various systems in feeding. Before giving you definite results, I wish to say that the profits that are shown on this chart are only comparative profits, that is they show the difference in the profit which results from the different management which was given the lambs. There is no charge made for pasturage, because all the lambs had exactly the same field to run over, and there is no cost added for labor, because it is a very hard matter to get at this, and the labor involved in the care of all the lots varied but very slightly. In explanation of this chart I wish to say further that we supposed that the lambs were to be sold at the end of each period. To get at exact results we had a butcher inspect the lambs and tell what he would give for them, each lot separately, and the prices that I have used on the chart to show the value of the lambs at the end of the different periods are the prices which were given to me by the butcher who inspected the lambs carefully. You will notice, in the case of the grain-fed lambs, that they have been carefully charged with the amount of grain that they had eaten up to the end of that period, and I desire to state further that this grain has been charged to them at current market prices.

We will suppose that in the first trial the lambs were sold at the end of the first period. It will be seen from the chart that there would have been at this time a profit of $3.41 per head from the lambs in Lot I., and only $2.73 from those in Lot III., which clearly shows that there was an advantage in feeding grain before weaning in this instance. Inferring that the lambs were to be sold in the fall at the end of the second period, it will be noticed in the chart that there would be a profit of $3.33 from the lambs of Lot I., and only $3.14 per head from the lambs in Lot III. This profit from Lot I. is above the cost of their food during the two periods. If the lambs were carried over winter and fed at the end of the third period it will be seen that there was a profit of $5.98 per head from those in Lot I., and $5.41 per head from those in Lot III. By instituting similar comparisons throughout the four periods it will be clearly seen, that no matter when the lambs were sold, there would be the same from those that were fed grain since birth. There is another point which should be referred to and that is the difference in the value per pound of the grain-fed lambs and those that had no

grain until fattening. At the end of each period throughout each trial the lambs were examined by a butcher and his opinion was taken as to the difference in the value per pound on the two lots. At weaning time this difference amounted to ½ cent per pound. In the fall it was generally 1 cent and in the spring it usually was ¾ cent per pound. The reason for this difference was stated by the butcher to be due to the inference that the grain-fed lambs would dress higher than those that had not received any grain. At the conclusion of the trial the lambs were killed and their dress weights obtained, and it was invariably found that the facts supported this inference although in some instances the differences were very slight.

We also found that the lambs fed grain since birth throughout were heavier than those that had not received grain until the fattening began. Samples of the fleeces of the sheep in the different lots were washed in hot water, and it was found that the increased weight of the fleece of the grain-fed lambs was almost wholly due to the greater amount of grease or yolk that was in their fleeces. The grain feeding seemed to help the growth of the fibre, although this was not very marked in some of the trials. Considering all things it seems clearly evident that it is best to feed grain to lambs that are being prepared for the market continuously from birth.

Grain-Fed Lambs Before Weaning.

Having decided that it is best to feed lambs grain before and after weaning, the next important point to determine is what grain will give the best satisfaction for feeding lambs before weaning. We have made definite experiments with cornmeal, oats and bran for this purpose. There were three lots of lambs with six in each of them, which were fed these grain foods as their ration on pasture. All of the lots received the same management and were treated similarly in every respect. The following table shows the most important results obtained from feeding these foods:

Six lambs fed.	Lot I. Cornmeal.	Lot II. Oats.	Lot III. Bran.
	lbs.	lbs.	lbs.
Weight at the beginning June 3rd	289.5	288.5	299.
Weight at ending July 29th	452.5	455.5	437.
Total gain in eight weeks	163.	167.	138.
Average weekly gain per head	3.4	3.4	2.8
Total grain eaten	251.	270.5	313.
Cost of grain (Oats 20c per bu; Corn 30c. per bu; Bran $13 per ton)	$1.25	$1.62	$1.87
Cost of 100 lbs. gain	.76	.97	$1.35
Amount of grain per lb. gain	1.5	1.6	2.2
Total loss of ewes	47.5	41.5	46.

It will be seen from this that the cornmeal gave the most profit, and next to this the oats and last the bran. As soon as these same lambs were weaned they were kept upon the same foods. They had the same pasture which consisted mostly of clover aftermath for the time, but during the greater part of the experiment they had inferior blue grass pasture. Each night the lambs were brought to the sheds, divided into the respective lots and received the different rations.

The results from this trial show that cornmeal is superior as a fattening ration to either oats or bran. The position of the two foods in this trial is different from what it was in the experiment that was made with lambs before they were weaned. If a general summary is made of the results from the two periods extending over sixteen weeks' feeding it will be seen that the cornmeal will be superior as a fattening ration to either oats or bran for feeding lambs before and after weaning. The oats rank next to the corn considering the data obtained from the two periods, while the bran proves inferior to either of the other two rations

	Lo I.	Lot II.	Lot III.
	Six lambs fed cornmeal.	Six lambs fed oats.	Six lambs fed bran.
Weight beginning June 29	452.5	455.5	437.
Weight at ending September 23	539.	499.	488.
Total gain in eight weeks	86.5	43.4	51.
Average weekly gain per head	1.8	.9	1.10
Total grain eaten	324.	337.	301.
Cost of grain (Oats 20c. per bus. Corn 30c per bus. Bran $13 per ton)	$1.71	$2.02	$1.80
Cost of 100 lbs. gain	$1.97	$4 64	$3.52
Average amount of grain per lb. gain	3.9	7.7	5.9

Ration for Fattening Lambs.

There are so many points to determine in regard to the different ration for fattening lambs that it is somewhat of a task to arrange the experimental data in a clear way so that the comparative value of the rations may be self-evident. I know of no better way than to consider only the money value of the different rations. Even this can only be determined in a general way. It is certain that the feeder of sheep for market follows this industry for the profit that there is in it, and the point that concerns him is, how much are the different grains and fodders worth for fattening sheep. He grows certain grains, selling in the market at a stipulated price, and he wishes to learn if he can dispose of his grain and fodder to more advantage by selling them or feeding them to wether lambs, or shall he sell what he has produced and buy others. Some say that the farmer should be satisfied with the manure which he obtains from feeding stock for his labor, if the cost of producing the food is also offset. Those who have made a study of feeding sheep have secured both fertility for their farms and profits for themselves, and there is no reason why others need be satisfied with less.

To make it possible to show the profits returned by feeding any ration, and also to put all the rations on a uniform basis for comparison, the following scale of prices will be used in estimating the cost of all the rations which follow. These are as near average prices as it is possible to estimate in a general way.

Hay	$ 8 00 per ton, .4 cents per pound.
Corn fodder	4 00 per ton, .2 cents per pound.
Roots	2 00 per ton, .1 cent per pound.
Ensilage	2 00 per ton, .1 cent per pound.
Corn	40 per bushel (56 pounds), .7 cents per pound.
Bran	13 00 per ton. .6 cents per pound.
Oats	30 per bushel (32 pounds), .8 cents per pound.
Oilmeal	25 00 per ton, 1.2 cent per pound.
Wheat	53 cents per bushel (60 pounds), .8 cents per pound.
Peas	60 cents per bushel (60 pounds), .1 cent per pound.
Barley	45 cents per bushel (48 pounds), .9 cents per pound.
Cottonseed meal	28 00 per ton, 1.4 cent per pound.

In estimating a profit from feeding a ration, the wether lambs will be charged with their cost price at three cents per pound, and the food they ate at the foregoing prices, and they will be credited with their value when followed at four cents per pound. The difference between these amounts will be accepted as the amount of profit produced. While this may not be entirely satisfactory, yet it will come the nearest to meeting the enquiries of the practical feeder. It is not wholly satisfactory as a method of comparing rations, as the sheep fed by different experiments must have varied somewhat, and it is not completely reliable in presenting the profits, as there are many other minor matters that are to be considered that vary much with local conditions.

Succulent Food for Fattening Lambs.

The value of roots in a ration was tested at the Michigan Experiment Station (bulletin 113). Corn and hay were fed against corn, roots and hay. Ten, weighing 824 pounds, ate during the period of fifteen weeks 1,579 pounds corn, 1,097 pounds hay, and they gained a total of 328 pounds, or a weekly gain of 2.18 pounds per head. The ten

lambs receiving the corn, roots and hay weighed 817 pounds, and they ate 1,612 pounds corn, 984 pounds of hay, 2,720 pounds roots, and they gained 397 pounds, or a weekly gain of 2.64 pounds.

The lambs receiving the dry ration in these herds, according to the method of valuation before outlined, returned a profit of fifty-nine cents per head, and those receiving the succulent ration sixty-two cents per head.

In other tests at the same station, corn and oilmeal were fed with hay against the same kind of grain and hay with roots. The ten lambs receiving the ration weighed 829 pounds, and in the fifteen weeks they ate 347 pounds oilmeal, 1,388 pounds corn and 1,152 pounds hay, and they gained 357 pounds, or a weekly average per head of 2.38 pounds. The ten lambs that received the succulent ration weighed 842 pounds, and they ate 342 pounds oilmeal, 1,373 pounds corn, 970 pounds hay and 2,675 pounds of roots, and they gained a total of 392 pounds, or an average weekly gain of 2.61 pounds per head.

The profit returned from feeding the dry ration was forty-one cents per head and hat from the succulent ration was thirty-eight cents per head.

At our station a ration of oats, corn and oilmeal with hay was fed against a similar ration containing roots. The four lambs fed the dry ration weighed 367.5 pounds, and during the eleven weeks they ate 49.9 pounds oilmeal, 124 8 pounds corn, 392 6 pounds oats and 577 pounds hay, and they gained 116.5 pounds, or a weekly average of 264 pounds per head. Those fed the succulent ration weighed 369 pounds, and they ate forty-five pounds oilmeal, 109.5 pounds corn, 340 5 pounds oats, 612 pounds hay and 225 pounds roots, and they gained 109 pounds, or a weekly gain per head of 2.48 pounds.

The wether lambs fed the dry ration returned a profit of thirty cents per head, and those fed the root ration gave a profit of thirty-four cents per head.

These results do not show a decided difference in favor of either ration, but in feeding large numbers the advantage appears more decidedly in the decreased risk of deaths due to digestive disarrangements.

Roots or Silage.

Roots and silage have been compared for fattening wether lambs without any marked difference in their value becoming apparent. At the Michigan Experiment Station (Bulletin 107) twenty lambs weighing 1,462 pounds were fed fifteen weeks 1,172 pounds oats, 1,172 pounds bran, 13,413 pounds roots, and 2,439 pounds hay, and they gained 589 pounds, or a weekly average gain of 1.7 pounds per head. The twenty weighing 1,490 pounds that received the silage ate 1,172 pounds bran, 1,172 oats, 8,108 pounds silage, and 1,974 pounds hay, and they gained 586 pounds, or a weekly gain of 1.7 pounds per head.

Those receiving the silage ration, according [to the method of calculation adopted, returned a profit of twenty-nine cents per head, and those on the ration of roots just about paid for the food they consumed at market prices.

In a similar trial at our station four lambs weighing 367.5 pounds in eleven weeks ate 225 pounds roots, 612 pounds hay, forty-five pounds oilmeal, 109.5 pounds corn and 340.5 pounds oats, and they gained 109.5 pounds, or a weekly gain of 2.48 pounds per head weekly. The four lambs receiving the silage ration weighed 369 pounds, and they ate 223 pounds silage, 509.5 pounds hay, 43.4 pounds oilmeal, 108.9 pounds corn and 334 pounds oats, and they gained 102.5 pounds, or a weekly gain per head of 2.32 pounds.

The feeding of the two preceding rations gave a profit of thirty-four cents per head from the root ration and forty cents per head from that containing the silage.

These trials show us material differences in the feeding value of these succulent foods; if there is any, the rate of gain is in favor of the roots, and the cost of gain favorable to silage.

Corn.

This assuredly is the most fattening farm grain that may be fed to sheep. In relying on it alone, however, there is much difficulty in maintaining the appetites of the sheep and in preventing disorders and deaths. Corn, roots and hay were fed in a ration at the Michigan Experiment Station (Bulletin 107) against other lots of different rations, and the corn ration gave a weekly gain per head of 2.6 pounds, which was only equalled by a mixture of corn and oats. Of the corn ration ten wethers, weighing 830 pounds, ate in fifteen weeks 1,757 pounds corn, 1,190 pounds roots and 1,670 pounds hay, and they gained 443 pounds, or an average weekly gain per head of 2.6 pounds. In another trial at the same station ten lambs, weighing 817 pounds, ate in fifteen weeks 1,612 pounds corn, 964 pounds hay and 2,720 pounds of roots, and they gained 397 pounds, or an average weekly gain per head of 2 64 pounds. In the first trial charging and crediting the lambs at the rate formerly submitted, the profit was fifty-eight cents per head, and in the second trial the profit returned was sixty-two cents per head.

Corn silage and corn fodder were fed in two trials at this station. In the first (Report VII. page 16) three wether lambs, weighing 261 pounds, consumed in eighty-six days 377 pounds corn, 290 pounds corn silage and 150 pounds corn fodder and twenty-two pounds potatoes, and they gained ninety-eight pounds, or an average weekly gain of 2.6 pounds per head. In another trial (Report VIII.) six wether lambs, weighing 495.6 pounds, ate in twelve weeks 703 pounds shelled corn, 409.7 pounds corn silage, and 655.5 pounds corn fodder, and gained 181 pounds, or an average weekly gain of 2.5 pounds per head. The ration fed in the first trial returned a profit of $1.04 per head, and that of the second trial ninety-two cents per head. These are the most profitable gains that have been attained at our station.

Corn and hay were fed for fifteen weeks in the trials conducted at the Michigan Experiment Station. The ten weather lambs weighed 824 pounds, and in fifteen weeks they ate 1,579 pounds corn and 1,095 pounds hay, and gained a total of 328 pounds, or a weekly gain per head of 2.18. At our station five wether lambs, weighing 431½ pounds, ate in eight weeks 427.75 pounds corn and 288.5 pounds hay, and they gained 104½ pounds, or a weekly gain of 2.61 pounds per head. In the trial at the Michigan Station the wethers returned a profit of fifty-nine cents per head. Using the scale of prices before decided upon, and in the trial at our station eighty-seven cents per head profit was received. Cracked corn and hay were fed at the Minnesota Experiment Station (Bulletin thirty-one) to ten wether lambs, weighing 710 pounds, and in twelve weeks they ate 1,103 pounds grain and 849 pounds hay, and gained 211 pounds, or an average weekly gain per head of 1.75 pounds. This ration returned a profit of forty-four cents per head.

Oats.

In beginning to fatten wether lambs, it is safe to begin the grain feeding with oats. The lambs like them and they will begin to eat them at once. Fed alone, however, they do not produce as great a gain as corn, hence, as the fattening proceeds, the quantity should be gradually decreased. At the Ontario Experiment Station (Report 1884, p. 189) four weather lambs, weighing 416 pounds, were fed in fifteen weeks a total of 735 pounds oats, 1,092 pounds hay and 546 pounds roots, and they gained 156 pounds, or a weekly gain of 2.6 pounds per head. At the Michigan Experiment Station (Bulletin 107) ten lambs, weighing 834 pounds, were fed in seventeen weeks 1,963 pounds oats, 1,160 pounds roots and 1,687 pounds hay, and they gained 379 pounds, or a weekly average per head of 2.12 pounds. Charging the food in the ration at market prices, and crediting them with the advance due to the increase, there is no profit in either of these rations.

Peas.

The best satisfaction will be obtained from feeding peas when they are split or crushed and fed with other foods. At the Ontario Experiment Station (Report 1884) four wether lambs, weighing 493 pounds, were fed in fifteen weeks, 628 pounds peas, 1,050 pounds hay, and 460 pounds roots, and they had gained 105 pounds, or an average

weekly gain of 1.75 per head. Charging the peas at sixty cents per bushel, and the other foods at current prices, and crediting the sheep with the value of the increase, 4.5 cents per head was lost by feeding this ration.

Barley.

This grain has been experimented with for fattening sheep most extensively at the Rothamstead Experiment Station. In one trial (R.A.S. Journal, Vol. 10, 1849, page 296) five wether lambs, weighing 602 pounds, ate in eighteen weeks 630 pounds barley and 1,879 pounds clover chaff, and on this ration the sheep increased 139 pounds, or an average weekly increase of 1.54 pounds per head.

At the Minnesota Experiment Station (bulletin thirty-one) barley was fed to ten wethers weighing 733 pounds, and in twelve weeks they ate 1,268 pounds barley and 630 pounds hay, and they increased 199 pounds, or 1.65 per head weekly. Not knowing the market value of clover hay chaff, the Rothamstead results will be overlooked in estimating the profits of the ration that was fed there. In the instance of the trial at Minnesota Station, charging the barley at forty-five cents per bushel of forty-eight pounds, and the other foods and the lambs at market prices the lambs paid a profit of thirteen cents per head.

Ground barley has given slightly better returns. Four wether lambs, weighing 686 pounds, were fed at the Rothamstead station (R.A.S. Journal, Vol. 10, 1849, page 329) 280 pounds ground barley and 3,867 pounds mangels in ten weeks, and they gained eighty-one pounds, or a weekly increase of two pounds per head. In another trial at the same station (R.A.S. Journal, Vol. 23, 1862, page 91), ground barley was fed with meadow hay chaff to five wethers weighing 589 pounds, and in thirty-two weeks they ate 1,120 pounds barley and 2,899 pounds meadow hay and straw chaff, and they gained 164 pounds, or a weekly increase of one pound per head. Being unaware of the market price of meadow hay and straw chaff this trial will be omitted. In the first trial with ground barley and mangels, the wethers receiving them yielded a profit of forty-three cents per head.

Crushed or grittled barley was fed in the same experiment mentioned in discussing crushed oats, whole wheat, and the mixtures of oats and barley, and wheat and barley. It is stated (R.A.S. Journal, Vol. 24, 1888, page 476) that the eight wethers weighing 959¼ pounds, were fed, in 112 days, 658 pounds grittled barley, 2,240 pounds Swedes and 224 pounds hay chaff, and they gained 365¾ pounds, or an average weekly gain of 2.8 pounds per head. Charging the barley at forty-five cents per bushel, and the other foods at market prices the increased value of the sheep shows a profit of $1.89 per head from feeding this ration.

Grain Mixture for Fattening Lambs.

There is abundant evidence indicating that the merit of a grain mixture as a part of the ration lies in the fact that the sheep like it better than the unmixed grains, eat more of it, and, as a result, gain more. The fact that they eat more seems to be the chief element in making the profit less than in the feeding of some of the foods unmixed.

Peas and Corn. This mixture was tried in an experiment in feeding whole corn, corn and oats, and corn, peas and oats, to wether lambs. The corn gave the poorest results of all, as far as cost of gain is concerned. The standing of the rations to the rate of gain was as follows: Corn and hay, 2.6 pounds per head weekly; oats and corn and hay, 2.7 per head weekly; corn and peas and hay, 3.15 per head; and the oats, corn, peas and hay, 3.01 per head. The cost of 100 pounds gain was, corn, $3.99; corn and oats, $4.46; corn and peas, $4.20; and the corn, peas and oats, $4.46. The five wethers that received the mixture of corn and peas weighed 428 pounds at the beginning of the experiment, and ate, in eight weeks, 251.9 pounds peas, 251.9 pounds corn, 256 pounds hay, and they gained 126 pounds, or an average weekly gain of 3.1. The peas might be called split and the corn was fed whole. The wethers fed on this ration returned a profit of eighty cents per head.

Oats and Corn. This mixture is likely used more frequently than any other in the west. In the trials at the Michigan Experiment Station (Bulletin 107), the ten lambs receiving corn and oats with roots and hay were only equalled in weekly gain by those fed corn alone. This mixture surpassed bran alone, corn and bran mixed, oats and bran, and another of corn, oats and bran in weekly gain and in cost of gain. The ten wether lambs fed oats and corn weighed 842 pounds at the beginning of the experiment, and in seventeen weeks they ate 967.5 pounds oats, 967.5 pounds corn, 1,190 pounds roots, and 1,171 pounds hay, and they gained 436 pounds, or an average weekly gain of 2.6 pounds per head. At our station it has been our custom in fattening lambs in the series of trials that have been made in feeding lambs grain continuously from birth, to feed oats at first during the fattening then add corn and finally, if the lambs appear to need it, to add some oilmeal. In one of the trials corn and oats were fed alone throughout the fattening, with hay in addition. Fifteen lambs were fed this ration for twelve weeks. At the beginning of the experiment the fifteen weighed 1,334 pounds, and in twelve weeks they ate 1,523.5 pounds corn, 1,073 pounds oats, 1,320 pounds hay, and they gained 529.5 pounds, or an average weekly gain per head of 2.9 pounds. The profit on the lambs fed on this ration at the Michigan Experimental Station would amount to fifty-four cents. per head, while that from those fed in our trials would be sixty-seven cents, according to the method of estimation that has been used in the previous instances. These figures indicate that both in direct profit and rate of gain the oats and corn mixture gives results superior to most other mixtures, while observation of the conduct of the wethers when being fed this ration justifies the assertion that it is an exceptionally wholesome food for sheep.

Peas, Oats and Corn. In the trial conducted at our station that was before referred to in commenting on the value of peas and oats, one lot of five wethers was fed a grain mixture of peas, oats and corn with hay. The five wethers weighed at the beginning of the experiment 431 pounds, and in eight weeks they ate 164.5 pounds oats, 164.5 pounds corn, 164 5 pounds peas, 300 pounds hay, and gained 120½ pounds, or an average weekly gain of three pounds per head. The profit returned by each lamb fed this ration was seventy-six cents per head, which is slightly below that made by the lots receiving corn and peas as their grain ration, and also less than the amount yielded by those receiving whole corn.

Bran and Corn., This mixture was tried at the Michigan Experiment Station in a feeding experiment including also bran and oats, and bran oats and corn as the distinguishing parts of the ration. The ten wether lambs fed corn and bran gained 3.57 pounds in the seventeen weeks, or 2.10 pounds per head weekly. The ten receiving oats and bran gained 541 or 2.11 pounds per head weekly, and those receiving a mixture of these foods gained 581 pounds or 2.3 pounds per head weekly. The ten wether lambs weighing 866 pounds that received the corn and bran ate 986.5 pounds bran, 1,190 pounds roots, 1,698 pounds hay, and gained 358 pounds. The profit made by each wether receiving this ration was twenty-one cents per head.

Oats and Bran. This mixture was also tried in the experiment described in the previous paragraph. The fifteen wether lambs weighed 1,258 pounds when the experiment started and in seventeen weeks they ate 1,467.5 pounds oats, 1,467.5 pounds bran and 2,580 pounds hay and gained 541 pounds. Using the prices that have been before adoped in estimating the profit in fattening lambs there was a profit of ten cents per head from feeding this ration.

Bran, Oats and Corn. The results from feeding this mixture are also reported (Bulletin 113) by the Michigan Experiment Station. The trial was made at the same time as those with oats and bran and with bran and corn. The fifteen wether lambs receiving this ration weighed 1,250 pounds and in seventeen weeks they ate 984 3 pounds bran, 1,785 pounds roots, and 2,481 pounds hay and gained 581 pounds. The profit returned by each lamb receiving this mixture of grains was twenty-two cents per head. It will be seen from these trials that the best returns in profit resulted from feeding the corn and bran mixture and the corn, oats and bran ration for both of these surpassed the oats and bran.

Corn and Oilmeal. In the trials at the Michigan Experiment Station (bulletin 113) corn and oilmeal gave high results. Ten wether lambs weighing 829 pounds ate in fifteen weeks 347 pounds oilmeal, 1,388 pounds corn, and 1,152 pounds hay, and they gained 357 pounds or an average weekly gain of 2 38 pounds per head. A profit of forty-one cents per head resulted from feeding this ration.

Cracked corn and oilmeal were fed in a ration at the Minnesota Experiment Station (Bulletin 31). Ten lambs, weighing 722 pounds, ate in twelve weeks 1,427 pounds oilmeal, 1,284.3 pounds cracked corn and 634 pounds hay, and they gained 289 pounds, or an average weekly gain of 2 4 pounds per head. The profit from feeding this grain mixture with hay was fifty-eight cents per head.

Barley and Oilmeal. This mixture was fed in the same experiment as the preceding at the Minnesota Experiment Station (bulletin 31). The ten wether lambs, weighing 757 pounds, ate in twelve weeks 159.1 pounds oilmeal, 1,431.9 pounds barley and 603 pounds hay, and gained 274 pounds, or an average weekly gain of 2.2 pounds per head. Each lamb, according to the prices submitted, returned a profit of thirty-seven cents, which is not so great as that resulting from the ration containing wheat and oilmeal.

Barley and Oats. In the sheep feeding trials at Woburn (R.A.S. Journal, Vol. 24, 1888, p 476) oats and barley mixed equally by weight, returned a weekly increase of three pounds per head; the oats alone 2.9 pounds, barley alone 2.8 pounds, and the oats and wheat 2 6 pounds per head weekly. Wheat alone did the best of all the grains fed, it giving a weekly increase of 3 6 pounds per head. The eight wether lambs receiving oats and barley weighed 949 75 pounds, and they ate in 122 days 329 pounds oats, 329 pounds barley, 224 pounds hay chaff and 17,561 pounds Swedes, and they gained 384¼ pounds. The profit from each lamb was about eighty-five cents per head.

Corn, Oats and Oilmeal. The results that have been submitted from the feeding of different rations will go far towards justifying the practice we have followed in fattening wether lambs when they were not required to be on different rations. In the third period, called fattening, in our grain-feeding trials with lambs that had not been fed grain before weaning, and those that had, have usually fattened on a grain mixture of this kind. They would be started on the oats and fed lightly for two or three weeks; then the corn would be introduced, and for seven or eight weeks the grain portion of the ration would be corn and oats. During the last two or three weeks oilmeal would be added to the ration, and on this mixture the wethers would be finished. Though this mixture has not been fed in a trial against other grains, yet it will not be amiss to submit the gains that our wethers have made on it. In the first trial with this ration eight wether lambs weighing 162.4 pounds ate in fourteen weeks 540 pounds oats, 270.4 pounds corn, 270 4 pounds oilmeal, 1,449 pounds corn fodder, 713 6 pounds roots, and they gained 323.2 pounds, or an average weekly gain of 2 88 pounds. In a second trial ten wether lambs weighing 921 pounds ate 1,171 pounds oats, 412 pounds corn, 388 pounds oilmeal, 973 pounds roots, 431 pounds corn fodder, and 1,002 pounds hay, and they gained 407 pounds, or an average weekly gain of 2.9 pounds. In another trial fifteen lambs weighing 1,261.5 pounds ate in fourteen weeks 1,365 oats, 1,111 pounds corn, 525 pounds oilmeal and 6,583.5 pounds hay, and gained 625.5 pounds, an average weekly gain per head of 2.97 pounds. The profit per head was ninety-three cents in the first trial, and in the second it was thirty cents per head, and in the last there was a profit of twenty-five cents per head.

It should be stated in conclusion that all of the results that are here given as to the profit per head from feeding the sheep these different rations are very conservative. In the first place, it would be fairer to allow more than one cent as the difference between the buying price and the selling price. In addition the charges that are made for the food included in the ration are fully twice as much as they would bring in the market at this time. The results, however, will afford a means of comparison to determine the difference in the profit from feeding different rations, but it should be remembered that these experiments have in many cases been made with lambs of different quality and different breeding. They indicate, however, that fattening sheep affords a certain and a near market for the many products that the farmer raises on his farm.

Mr. RENNIE: In feeding lambs for Easter we made a mixture of pulped roots, cut clover, bran, crushed oats, and a little flaxseed meal. This mixture was put in a trough for the lambs, in addition to the milk, and with this they grew rapidly so that lambs 3½ months old averaged seventy-five pounds each; most of them were Dorset horn, and twin lambs. One Leicester ewe, a single lamb, weighed nearly one hundred pounds. When the ewes are being bred in the fall I consider it important to give them nitrogenous food, such as clover, rape, mixture of oats and bran, and with that treatment we have excellent results. This spring one ewe had four lambs (a Cotswold) and raised three of them. The rams received the same extra care and feeding that was given the ewes, and were given a little flaxseed.

Q. Were the lambs any particular breed?

Mr. RENNIE: There were six Dorset horn ewes with twelve lambs, and then there was one Leicester, and one Oxford.

Col. BURTCH: What is your experience with lucerne?

Mr. RENNIE: A number of sheep and lambs died during the spring of 1894, and when opened were found to contain a hard ball of what was supposed to be wool in the stomach; but in taking it to Prof. Panton and having it analysed it was found to be some fibre—mostly fibre—and in taking some of the lucerne hay that the sheep had been feeding on, he found on examination the fibre to be much the same in the lucerne stalk as in those balls. Lucerne hay when cut too ripe and dry is a dangerous food. If cut green before coming into bloom, I do not presume there would be any danger in feeding the hay, or from pasturing on green lucerne. We plowed up all the lucerne on farm and sowed instead the common red clover, alsike and timothy.

Rev. W. F. CLARK considered that this mixture was superior to lucerne clover for feeding purposes.

Q. I would like to ask Mr. Craig what he thinks about Dorset Horn as an anti-dog sheep?

Mr. CRAIG: I do not believe there is any sheep of that kind, I wish we could get some in this country.

Mr. RENNIE: Last fall dogs got among our sheep one night and were making a great noise. When the men got to the place a Leicester was fighting the four hounds. She died afterwards, they did not kill her but she was so excited fighting the hounds that the shock was too much for her. So that is the best anti-dog sheep we have.

BEEF RINGS.

By W. S. FRASER, BRADFORD, ONT.

Beef ring is a term applied to the union of a number of farmers for the purpose of supplying themselves with fresh meat during the summer months. It is done by killing an animal each week, and dividing it equally among the members in a way that each one receives a boiling piece, a roast, and piece of steak each week. The *modus operandi* is as follows:

In the winter season a meeting is held at which tickets are drawn, to decide the order in which the members are to furnish the animals. Members may exchange tickets after drawing if they find it to be mutually advantageous.

A person is appointed to do the butchering. It is not necessary that he be a professional, but one that has taste to do his work in a tidy manner. A secretary is also appointed. The time for commencing operations is decided at the meeting as also is the price to be paid for butchering which is usually $2 00 per head.

Duties of Butcher. He provides a suitable place for killing, furnished with a hook for each member, on which each man's share is to be hung.

He kills the animal in the evening and cuts it up in the morning, weighs each share, hangs it upon its respective hook before six o'clock, and gives hide, head, heart, and fat to owner of animal.

He keeps an accurate account of the weight of each animal, of the quantity that each one receives per week, and in case of an animal being of inferior quality, he shall consult with the Secretary and decide upon the value of the beef per pound, prices varying from four and a half to six cents per pound.

He changes each week the order in which the cuts are distributed, *e.g.* the cut No. 1 receives this week No. 2 receives next week, and No. 1 takes the place of No. 16.

He renders to Secretary an account at the end of season, of weight of each animal and of weight of meat received by each member, as shown by the following table :

2. Front shank rump, No. 2..... 3. Neck and rump, No. 1..... 4. Flank and roast, No. 2..... 5. Shoulder and roost, No. 4..... 6. Hind shank and roast, No. 3..... 7. Second rib and roast, No. 1..... 8. First rib cut and sirlion.....	—	A's beef.	B's beef.	C's beef.	D's beef.	E's beef.	F's beef.	G's beef.	H's beef.	I's beef.	J's beef.	K's beef.	L's beef.	M's beef.	N's beef.	O's beef.	P's beef.
1. Brisket and roast, No. 5.....	1. A.	26	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
2. Front shank and rump, No. 2.....	2. B.	29	....	....	....	....	....	....	....	....	....	....	....	..	....	....	....
3. Neck and rump, No. 1.....	3. C.	27	....	....	....	....	....	....	....	....	....	....	....	....	...	....	....
4. Flank and roast, No. 2.....	4. D.	30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
5. Shoulder and roast, No. 4.....	5. E.	28	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
6. Hind shank and roast, No. 3.....	6. F.	29	....	....	....	....	....	....	....	....	....	....	....	....	...	....	....
7. Second rib cut and roast, No. 1.....	7. G.	25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
8. First rib cut and sirlion	8. H.	27	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
9. Brisket and roast, No. 5.....	9. I.	26	....	....	....	....	....	...	....	....	....	....	....	....	....	...	....
10. Front shank and rump, No. 2.....	10. J.	28	....	....	....	....	....	....	....	....	...	....	....	....	....	....	....
11. Neck and rump, No. 1.....	11. K.	30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
12. Flank and roast, No. 2.	12. L.	26	....	..	...	....	....	....	....	....	....	....	....	....	....	....	....
13. Shoulder and roast, No. 4	13. M.	27	....	....	...	....	....	....	...	....	....	....	....	....	....	--	....
14. Hind shank and roast, No. 3.....	14. N.	31	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
15. Second rib cut and roast, No. 1.....	15. O.	25	....	...	....	....	....	...	....	....	...	...	....	....	....	....	....
16. First rib cut and surlion.....	16. P.	27	....	....	....	....	....	....	....	....	....	....	....	....	...	....	....	....
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This time-table represents the way in which the beef is to be divided and weighed out to each person. The diagram represents A's beef being slaughtered and weighed out to the men composing the ring. No. 1 cut goes to No. 1 man the first week; to No. 2 man the second week, and to No. 3 man the third week, etc. This is done by moving the long list of cuts (at the left edge of time-table) down one space for every beef that is slaughtered, which changes the cut for each man. This slip is let down week after week until No. 2 comes opposite No. 1 man, then No. 1 cut is placed opposite No. 1 man again, as all the cuts in one half of the beef is contained in the first eight numbers, and the other half of the beef has the same cuts in it.

A's beef weighs 441, pounds which he is credited with. The numbers below each man's name is what he puts in, and the numbers opposite each man's name is what he takes out.

Duties of Secretary. He furnishes tickets with numbers on, which the members draw from a box, to decide the order in which they are to supply the animals.

He acts as valuator in case an animal is thought by the butcher to be below the standard in quality.

At the close of the season, he takes from the butcher's account, the quantity received by each, and presents to each individual member a statement of this and of the weight of animal furnished and the price per pound of all. If A's animal weighed 400 pounds and he, during the season, received 425 pounds, he must pay for the 25 pounds received at the rate of 6 cents per pound, if all beef has been up to standard. If B furnish an animal that is decided to be worth only 5 cents per pound and all the others are up to the standard, he is charged 6 cents for all meat received except the cuts he received of his own animal which will be charged to him at 5 cents and all the other members will be charged at the rate of 5 cents for B's beef. If a member receive less than the weight of the animal furnished he shall be paid for the amount he is deficient at the rate at which his animal was valued.

Duties of Members. They shall attend meetings, draw their numbers, select butcher and secretary, and decide upon the time when they commence operations.

Each one shall furnish a young well-fatted animal that will dress from 400 to 450 pounds, have it ready when his turn comes, and bring his animal to slaughter house 24 hours before time to kill.

They shall come for their shares of meat the morning after it is killed.

After the season is over they shall attend a meeting at which they will pay or be paid—as the case may be—the amount of the difference between their receipts and the weight of their beef.

The above is the way in which beef-rings have been operated in the township of West Gwillimbury, Simcoe Co., for a number of years. It is simple, easily worked, and gives good satisfaction. Sixteen is the most suitable number of members for a ring-killing every week. Some continue for a term and a half making twenty-four weeks, for the last eight weeks the members pair up and furnish an animal between two. A ring may be operated with only eight members, by killing every two weeks.

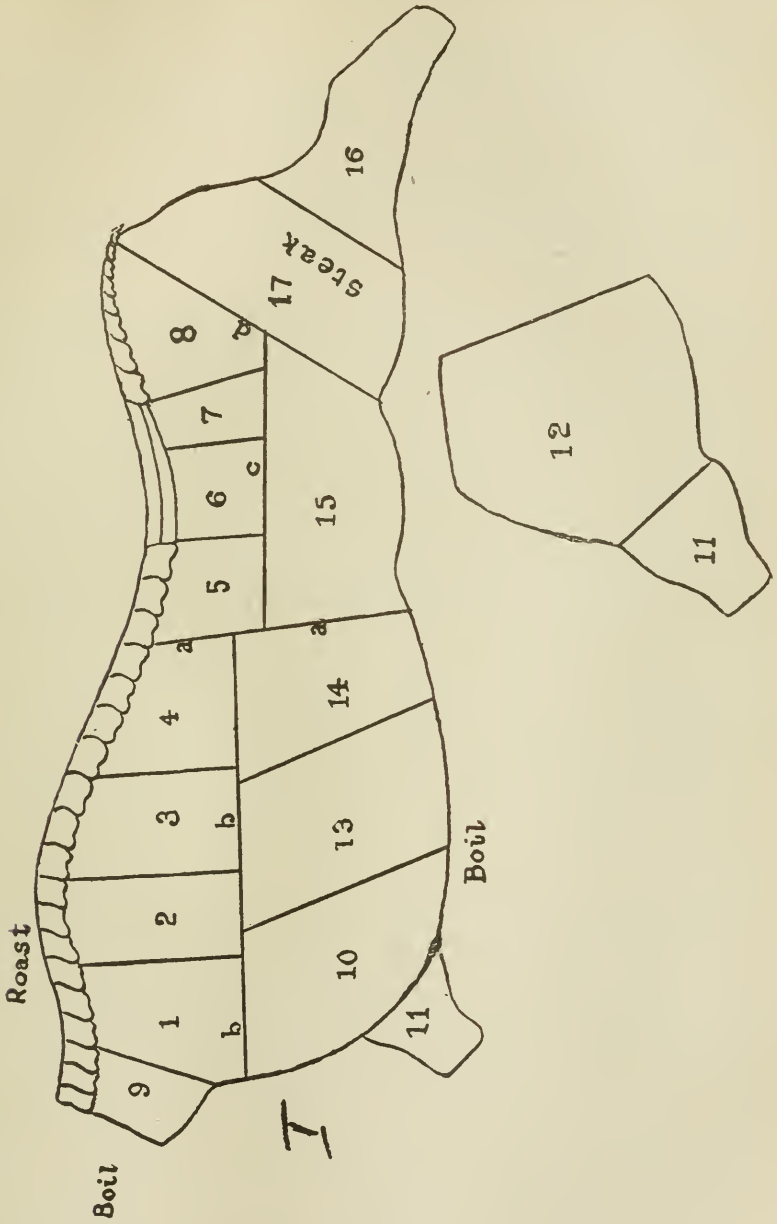
Advantages.

Farmers have fresh meat at first cost.

Fresh beef in the summer is more healthful than salt pork, thereby saving much suffering and perhaps doctor bills as well.

Farmers' wives who have fresh meat at their command have less labor and more pleasure in preparing meals than they otherwise would have.

Fig. 1. Represents one-half of beef lying on the table ready for the saw. Before letting this half down divide it in the middle by running a saw across at "a" between roasts 4 and 5, leaving two ribs on hind quarter. After laying both quarters on the table divide fore-quarter at line "b."



No. 9. Represents neck. Saw neck off leaving three joints on it.
No. 1. Represents roast No. 1. Saw roast No. 1 off, leaving three joints on it.
No. 2. Represents roast No. 2. Saw roast No. 2 off, leaving three joints on it.
No. 3. Represents roast No. 3. Saw roast No. 3 off, leaving three joints on it.
No. 4. Represents roast No. 4. Saw roast No. 4 off, leaving four joints on it.
No. 11. Represents front shank. Saw front shank off above upper joint.

No. 14. Represents second rib cut. Saw it off, leaving five ribs on it.

No. 13. Represents first rib cut. Saw it off, leaving four ribs on it.

No. 10. Represents brisket.

No. 12. Represents shoulder, which lies directly under brisket as represented in Fig. 1.

Then take the hind quarter and divide it at line "d."

No. 15. Represents flank. Cut flank off at line "c."

No. 5. Represents roast No. 5. Saw roast No. 5 off, with three joints on it.

Nos. 6, 7 and 8. Represents sirloin, rump No. 2 and rump No. 1, respectively. Divide these three as near to the same weight as possible.

No. 17. Represents steak. Cut steak into slices giving a slice to each person.

No. 16. Represents hind shank after steak is taken off.

After this half of the beef has been cut up it is divided between the first eight persons, as shown by time table, giving each person a roast, a boil piece, and a slice of steak. Then the other half of beef is taken down and cut up in the same manner.

R. O. Tye (New Hamburg): The Wilmot Beef Syndicate was formed in the spring of 1895 with twenty members. Two of the members were appointed to buy the animals which they did from the drover. The drover agreed to deliver one each week at the slaughter house. No animal was to be over six years old and was to weigh about four hundred pounds dressed meat, for which he was to receive $6 per hundred pounds dressed weight. The butcher was a farmer and a member of the syndicate. He dressed the animal and cut it into twenty portions so that every person would have a different part every ten days. After the meat was weighed it was hung on hooks opposite each person's name. The butcher also acted as secretary and treasurer of the syndicate and received $1.50 for each beef killed; he sold the hide and tallow which went to reduce the price of the beef. The head, heart and liver were taken by the members in turn. The members paid in some money monthly. They settled up in the fall and found that the meat had cost them $5.70 per hundred pounds. They killed twenty-five animals during the summer, and next season they expect to have a good many more members and will either get larger animals or kill twice a week.

Elmer Lick, (Oshawa): We manage our beef-ring somewhat differently to what Mr. Fraser speaks about. We have twenty in our ring. Six of these divide their portions with six others, thus fourteen receive full portions and twelve receive one-half portions. Those who can use twenty to twenty-five pounds per week do not divide their portions. We have strict rules as to the quality of the animals killed. They are to be under three years of age, a steer or heifer in good condition and sound health, weighing dressed from three hundred and seventy-five to five hundred pounds. A committee of three is appointed to whom the butcher refers if any animal is thought to be unsatisfactory. We sign the rules, and at that time draw lots to determine the order in which we are to furnish the animals. After drawing lots, some may make changes which will be mutually advantageous. No. 1 furnishes his animal the Tuesday evening before the first Wednesday in June. The animal is slaughtered on Wednesday evening and cut up ready to take away on Thursday morning. The animal is to be brought Tuesday so that it may be cool before being slaughtered. An animal is killed each Wednesday for twenty weeks. Each person in the ring is to furnish two bags with a shir string at the top of each to hang it up by. One is taken with the meat one week and the other left for the next week's meat. We pay our butcher $2.25. He kills, cuts up, weighs each part, and keeps a strict account of weights, and he also markets the hides. The hide, head, tongue, heart, etc., belong to the person bringing the animal. The butcher cuts the beef into twenty lots, each containing a roast, a boil and a steak. These are weighed out each time and then placed on a table in rotation. After weighing each man's share it is placed in one of the bags and hung on a nail. The bag should have the name of the owner marked on it. Our meat is ready for us early in the morning. It is ready for cooking, all bones being cut properly. At the end of the season we call a meeting to settle for the balances. At this meeting each person, who has received more than he put in, pays for it at a settled price (for two years our price has been six cents per pound; we have lowered to five cents.) Those who have put in more than they have received, are paid at the standard rate. We arrange for next season's ring at the time of settlement, and appoint

a president, secretary and managing committee, and also a committee to decide on the quality of the animal. The managing committee are given power to arrange for killing and other necessary arrangements. Our method of keeping the beef is to use steak and roast first, meantime the boil is either put in brine and kept until Monday or placed in a refrigerator. You should not judge the keeping qualities of fresh beef like this, by the keeping qualities of the pieces you buy from a butcher, as the purchased meat has usually been killed several days, and kept by aid of ice. The fresh meat will keep much easier than a person would expect. It was very seldom that we had any to use on Wednesday. One thing that requires care on the part of the butcher is that he should be exact in rotating the lots of meat so that each person would receive all the parts of an animal. Our people are pleased with the ring; in fact, there are several others who would like to join in and enjoy fresh beef of good quality at cost price, but our ring is constantly full.

J. R. Randall, * (Newmarket): The first step necessary is to obtain the names of sixteen persons, who are willing to enter into such a contract. There should be sixteen because the carcass can be more satisfactorily divided into that number of shares than any other. They should then meet as early as possible, draw up a constitution and by-laws, appoint their officers, and they will be ready for business when the time arrives, provided every member will do his best to promote the welfare of the society. First, by endeavoring to furnish a first-class young animal, and, second, by bearing in mind that it is a mutual arrangement, that there are but four shanks on a beef, and that you must expect that many, but cannot get more in the sixteen weeks. I would advise having all heifers, because generally there is less proportion of bone, and they fatten better when young, without so much growth; they generally come better within the limits of weight. I enclose herewith a copy of our constitution and by-laws, which may, of course, be altered as desired. In our case the secretary-treasurer and butcher were the same person; there is a good deal of keeping accounts, and it makes a lot of work for one person. The standard price should be fixed as near the market price of good beef as possible. It is by this price that the beef is scored and settlements made at the end of the season. Where a whole share is not required in one family, it may be divided according to an arrangement made between the parties themselves. We have run it successfully for twenty four weeks in one season. After the term had expired some person or persons were appointed to purchase such cattle as were required. It was run for eight weeks, then each member would receive one-half of a whole beef in that time, and each would pay in proportion to the number of pounds of beef received.

Constitution.

I. This association shall be known as the ——————— Mutual Beef Association, and shall consist of sixteen members, whose object shall be to furnish each member with his quarter of fresh beef weekly during the specified season.

II. The officers shall consist of a president, secretary and treasurer, whose duties shall be such as usually pertains to such offices; also a managing committee of three members, whose duties shall be to provide a suitable place for slaughtering, settle all differences in regard to weight, and quality of animals furnished, and the general oversight of the work; and any vacancy occurring in any office shall be filled by a vote of a majority of members present at a meeting appointed by the society as hereinafter provided.

III. The officers shall continue in office for the period of one year, unless otherwise determined by a majority of said society.

IV. The president and secretary shall be and are hereby empowered to convene all meetings considered necessary by them, and any special meeting at the request of any five members given in writing.

V. Seven members shall constitute a quorum for the transaction of business.

VI. All persons becoming members of this society shall subscribe to the articles of this constitution and be governed thereby.

VII. The annual meeting shall be held at a place and on a day agreed upon, for the purpose of closing up the business of the current year, enrollment of members, election of officers, making arrangements for succeeding year's operations, and for the transaction of such other business as may be brought before the meeting, notice of which meeting shall be given each member by the secretary.

* This information has been supplied by Mr Randall, who is an associate of the Agricultural College, and who has been secretary, treasurer and butcher in connection with the beef-ring near Newmarket for several years.

BY-LAWS.

1. The society shall elect one of its members to the position of butcher (whose duties are hereinafter defined), who may secure some suitable person to perform said duties.

2. Each member shall furnish one heifer or steer, the age of which shall not exceed two years, and weighing about four hundred pounds, suitable for the purposes of the society during the season in his proper turn, said season to consist of sixteen weeks, commencing and ending at such times as may be determined at any regular meeting of the society.

3. The order in which each member shall furnish his animal, shall be decided by lot at the annual meeting, or at a meeting held at least three months prior to the day of first killing.

4. Each member shall deliver his animal at the place of slaughter at or before nine o'clock on the day appointed by the society for the slaughtering of each animal.

5. Each member furnishing an animal shall be entitled to and shall receive the rough tallow, head and heart of the same.

6. The butcher shall be the judge of the suitableness of all animals furnished and may reject any, subject, however, to an appeal to the managing committee.

7. The butcher shall have authority, and it shall be his duty, in fixing the price per pound of each animal delivered, to take into consideration the season of the year when such animal may be furnished, also the quality of said animal when dressed, according to a standard adopted by the society.

8. The butcher shall weigh each carcass when dressed, and keep an account of the same, giving proper credit to the member furnishing said carcass. He shall also cut up and distribute weekly to each member of the society an equal portion of the same, as near as he can judge in the division, and keep a strict account of the amount furnished each member per week, and at the end of each season settlements shall be made with the members of said society, in accordance with the accounts kept by the butcher.

9. The distribution the butcher is required to make in accordance with the foregoing rules, shall be accomplished by placing each member's portion on hooks under their respective names, at the place of slaughter, or at such other place as may be agreed upon by the society.

10. The butcher shall market all hides and pay over to the treasurer the money obtained by him for the same, and shall receive for his services the sum of two dollars per head for all animals slaughtered, cut up and distributed by him.

11. The money obtained by the butcher for hides shall remain as a fund in the hands of the treasurer, for the purpose of defraying the necessary expenses of the society, and settling the differences of accounts between members at the end of each season.

12 No member shall have the privilege of withdrawing from the society without the consent of a majority of said society, and in no case will a member be allowed to withdraw until his accounts are settled with the society.

13. The above articles and regulations governing this association shall remain in full force and virtue unless amended by a two-thirds vote, after a notice of such amendment has been regularly given.

REPORT OF COMMITTEE ON DAIRY EXPERIMENTS.

BY PROF. H. H. DEAN, DIRECTOR OF CO-OPERATIVE EXPERIMENTS IN DAIRYING.

Early in the spring a circular letter was sent to about one hundred leading cheese and butter makers in the Province, together with proper blank forms for making returns to the committee. Printed postal cards were sent to each maker, requesting a return of the blank forms properly filled in not later than November 15th. No respone was made to these, except from a few saying that for various reasons they had been unabled to conduct any experiments during 1895. Written postal cards were sent a second time, to a number of those who were thought to be the most likely to conduct the experiment. The general reply was, that owing to the bad season and pressure of work, they had been unabled to make experiments as requested. It would seem as if the work of 1895, so far as dairying was concerned, was a failure, but it was not altogether such. Money and labor spent in advertising, printed blanks, etc, serves to get the dairy work of the Union before the dairymen of the country, and the small sum of money ($15.38) which is spent, has done considerable good by reminding cheese and butter makers of the need of experimental work in connection with their business. It also shows how little exact work is done in our factories, when out of a whole season's business there was not sufficient accurate data to fill in the blank forms sent out by the committee, and the experiments were in direct line with every day work in the factories. If this work is to be continued successfully it would seem to me advisable to make the following features a part of the system:

I. The Union should aim to secure the co-operative support of the Dairy and Creamery Association in the co-operative experiments of dairying

II. The Union might offer some inducements to men who will conduct successful experiments. This inducement might be in the form of books on dairying, renet, cheese coloring, various dairy utensils. Experiments in agriculture, horticulture, etc., receive these in the shape of grain, trees, plants, etc., and a small outlay in dairy rewards would stimulate makers to be more accurate and observing, and have them to send these observations to the Union where they could be tabulated and summarized for the benefit of the dairy industry. I suggest these features for consideration in the work of 1896, and which is respectfully submitted on behalf of the committee.

THE EFFECT ON THE QUALITY AND QUANTITY OF CHEESE FROM THE PERCENTAGE OF FAT IN THE WHOLE MILK.

A very able, interesting and valuable address was delivered by Prof. Shuttleworth upon the above subject. As this address is embodied in the report of the Chemist, in a previous part of this volume, the reader will be enabled to obtain full information by an examination of this report.

Q. If milk is paid by the fat basis for cheese purposes, our men inform us that the expense to the factory would mean an addition of an extra man, one would not be able to do the work. What would be the additional expense to pay on the line which you have indicated? What would be the necessary expense to the factory to pay by your system?

Prof. SHUTTLEWORTH: In the fat basis he would require an extra man on one or two days of each month. The additional expense in paying on the fat and casein basis is no greater than by the fat basis alone.

Q. Draw off ten pounds of skim milk and add ten pounds of water; the milk shows just about the same quantity of fat, and it would be graded with the same amount of casein, would it not?

Prof. SHUTTLEWORTH: The milk from which has been drawn off ten pounds of skim milk, and to which ten pounds of water have been added, would certainly contain about the same quantity of fat; but this milk would not produce as much cheese. The correct cheese-producing power of such milk would not be estimated either by the pooling system or fat basis, nor by the fat and casein basis.

Q. It must be perfectly clear in the case of paying by fat basis that replacing the skim milk (containing the casein or curd) by water, lessens the amount of cheese that the milk will yield

Prof. SHUTTLEWORTH: Yes.

Q. Is it your opinion that the quality of the milk for cheese making is more correctly estimated by considering the casein as well as the fat contained in the milk?

Prof. SHUTTLEWORTH: Yes. We find the casein can be calculated in any milk of a known percentage of fat; 2.3 is taken as the average per cent. of casin in milk below 3 per cent. of fat; 2.4 in milk of 3 per cent. and under 4 per cent. of fat; 2.5 in milk of 4 per cent. and under 5 per cent. of fat; 2.6 in milk of 5 per cent. and under 6 per cent. of fat.

Dr. MILLS: It would appear from your investigation in milk at the College, and this investigation has been very extensive, that the casein does not increase proportionately with the fat. Dr. Van Slyke, who has done very useful work along this line has concluded that the ratio between fat and casein in milk is fairly constant, and that the casein varies as the fat varies. If that were so, the fat basis would be a correct basis of distribution. Since casein does not vary as fat, the fat basis does not give a fair distribution; it credits the richer milk with an unproportionately large yield of cheese.

Q. Practically speaking, if cheese makers get used to your plan, will it make more extra work, that is, more than paying by the fat basis alone?

Prof. SHUTTLEWORTH: Practically no more work. For example: In the fat and casein basis, where milk tests 3.5 per cent., casein is 2.4, and this will be simply added to the fat reading, making 5.9 to be entered instead of 3.5.

Mr. ROGERS: I would like to say a word that might be of some help to those that are considering the matter of expense of testing milk in factories. One gentleman here said that they raised objections in his factory and asked $100 a year extra for additional work. By the use of potassium-bichromate, the tests need to be made only once a month, which does not increase the cheesemaker's work very much. It would mean that he would require an extra man one, or at most two days—the time during which these tests are made.

Prof. SHUTTLEWORTH: What additional amount over wages received would you ask, if required to make the tests in paying upon a fat, or fat and casein basis?

Mr. ROGERS: When I ran a factory I usually got labor for that particular day when the test was going on; it would usually be $3 or $4 a month extra.

Dr. MILLS: The fat system is a much nearer approach to a fair method than any other method we know of except the one proposed which considers casein as well as fat.

Prof. SHUTTLEWORTH: Yes. The addition of two to the fat reading give results practically the same as those obtained by the use of numbers, representing the correct percentages of casein where the variations in fat are very little; but the addition of two to the fat reading leads to a greater discrepancy where the percentages of fat in the different lots of milk vary by one-half a per cent. and more.

CO-OPERATIVE TESTING OF SMALL FRUITS.

By H. L. HUTT, B. S. A., DIRECTOR OF CO-OPERATIVE EXPERIMENTS IN HORTICULTURE.

The committee for horticulture experiments, has for the past two years been giving its attention to the testing of some of the leading varieties of small fruits.

The work along this line seems to be attended with many difficulties, and on this account we are not yet able to give the results of experiments, although we are glad to be able to report progress. There is no difficuly in finding men who are willing to undertake the work. Both last year and this year there were forty more applications for plants than could be supplied. But there is a difficulty in obtaining reports from successfully conducted experiments. There are various reasons for this, some of which are beyond our control. In the first place, as we do not grow the plants they have to be sent out from a nursery, and notwithstanding, all our efforts to have them sent out early, some of them were sent out so late this year, that many of them failed to grow. This was the case with the strawberries. The other fruits, however, were sent out earlier, and more encouraging reports have been received with reference to these. The extreme drouths during the last two seasons made them very unfavorable for setting out young plants. Quite a number of experimenters report failure on this account. Again, most of those who were successful last year with their planting, are unable to report yields, this year, on account of the late spring frosts, which destroyed nearly all the fruit. In a few cases yields are reported from last year's planting of strawberries and raspberries, but they are not sufficient to form a basis for any conclusions as to the relative merits of the different varieties under test.

The experiments undertaken in 1894 were variety tests of small fruits as follows:

Strawberries—Wilson, Bubach No. 5, Williams and Bederwood—twelve plants each.

Raspberries—Marlboro', Cuthbert, Shaffer's Colossal and Golden Queen—six plants of each.

Black Raspberries—Souhegan, Gregg, Palmer and Tyler—six plants of each.

Currants—Fay's Prolific, Victoria, Raby Castle and White Grape—three plants each.

Fifteen lots of plants for each of the four experiments were sent out; sixty persons were thus engaged in last year's experiments. Of these sixty, forty-seven reported last fall on the growth of the plants; thirty seven reported again this fall, most of them reporting that there had been little or no fruit on account of frosts.

This year the same line of experiments was followed, the work being extended by adding to the list a trial of four varieties of gooseberries, viz: Houghton, Downing, Whitesmith and Industry—three plants of each.

With the increased grant, we were able this year to send out twenty lots of plants for each of the five experiments. This making one hundred persons engaged in this year's experiments. Of these one hundred, only fifty-two have yet reported on the growth of the plants this season. Their reports may be summed up as follows:

I. Strawberries.—11 reports, nearly all reporting failure to make plants live.

II. Red and yellow raspberries.—Seven reports, two report all plants living and the rest report one or more plants dead.

III. Black raspberries.—Seven reports; one reports all living, and the rest report, one or more dead.

IV. Currants.—Ten reports; four report all living and the rest report nearly all living.

V. Gooseberries.—Seventeen reports; thirteen report all plants living, and the other four each report but one plant dead.

Although the results so far are not the most encouraging, still we believe the work is a commendable one, and that progress is being made. Like hopeful fruit-growers, we try to take reverses cheerfully, and look forward to better crops, and better reports next year.

TREASURER'S REPORT.

Receipts.	$ c.	Expenditures.	$ c.
Balance from last year	32 33	Agricultural experiments	537 76
Government grant	950 00	Horticultural experiments	116 45
Membership fees	49 40	Dairy experiments	15 00
		Botanical and Entomological experiments	10 00
		Apicultural experiments	4 00
		Expenses connected with annual meeting	92 00
		Salary of editor	80 00
		Balance	176 52
Total	1,031 73	Total	1,031 73

We the undersigned auditors of the Ontario Agricultural and Experimental Union beg leave to say that we have examined the accounts of the Treasurer and find them to be correct.

T. F. Paterson.
J. F. Clark.

OFFICERS FOR 1896.

President.... Elmer Lick, Oshawa, Ont.
Vice-President.... D. Z. Gibson, B.S.A., Willow Grove, Ont.
Secretary and Editor.... C. A. Zavitz, B.S.A., O.A.C., Guelph.
Treasurer.... H. L. Hutt, B.S.A., O.A.C., Guelph.
Directors: Dr. Jas. Mills, O.A.C., Guelph; T. G. Raynor, Rosehall, Ont; R. F. Holterman, Brantford Ont; Nelson Monteith, Stratford, Ont; and C. A. Zavitz, O.A.C., Guelph, Ont.

COMMITTEES ON EXPERIMENTS.

Agriculture. C. A. ZAVITZ, B.S.A., (Director), Dr. MILLS, PROF. SHUTTLEWORTH, P. O. VANNATER, and K. HARCOURT, B.S.A.

Horticulture. H. L. HUTT, B.S.A., (Director), E. LICK, and N. MONTIETH, B.S.A.

Apiculture. B. F. HOLTERMANN, (Director), R. M. HUSBAND, and E. G. EMIGH.

Dairying. PROF. H. H. DEAN, (Director), H. L. BECKETT, B.S.A., and S. P. BROWN.

Economic Botany and Entomology. PROF. J. H. PANTON, (Director), M. W. DOHERTY, B.S.A., and F. C. HARRISON, B.S.A.

Live Stock. G. E. DAY, B.S.A., (Director), N. MONTEITH, B.S.A., W. W. BALLANTYNE, and R. E. COWAN.

THE ANNUAL SUPPER.

Following the large attendance and successful meetings of the Experimental Union during the day, the annual supper of ex-students, students and college officers in the evening was naturally the largest and most successful gathering of the kind ever held at the College.

At the close of the supper, President Mills opened the proceedings with the toast of the Queen, which was honored with three cheers.

HOW CAN THE EX-STUDENTS OF THE AGRICULTURAL COLLEGE MAKE THE BEST USE OF THE LESSONS LEARNED DURING THEIR COLLEGE COURSE?

DR. JAS. MILLS, PRESIDENT AGRICULTURAL COLLEGE, GUELPH, ONT.

1. *Do not find fault with what you see around you.* You may notice bad methods, poor appliances, and the most striking evidence of neglect and mismanagement—things deserving the severest censure; but you must hold your tongue. Farmers will not take advice from beardless boys, nor even from well-developed young men, if they are fresh from college.

2. *Improve your farm.* Do much; say little. Instead of finding fault and giving advice, take off your coat and go to work. Do something. Make an intelligent, persistent effort to improve your farm. There is great room for improvement on many farms. The soil is poorly cultivated, weeds are plentiful, fences are out of repair, and things about the farm buildings present an appearance of the most discreditable neglect—stones here, sticks there, a pile of rails or boards yonder, and an old sleigh or a broken implement somewhere else—all seeming to say that the owner is lazy or devoid of taste. Untidy men ought to give up farming. They are a disgrace to the beautiful country in which we live; and, like the old Quaker, I am disposed to say that the man who allows wild mustard, wild oats, quack grass, or other noxious weeds to take possession of his farm, is working too much land, is lazy, or does not understand his business.

Straighten and repair your fences; then keep them in order. Remove all piles of stones from your fields; you can haul them away to the woods or somewhere else in winter. Rest not, night or day, till your farm is clean—till you have all noxious weeds thoroughly under your control and most of them destroyed. Tidy things up and keep them tidy, around your house, in the yards, and about the farm buildings; and plant some trees (maple, elm, pine and spruce) to shelter and adorn your home.

3. *Implements.* Take good care of your implements and do not buy any more than you really need. The annual waste under this head throughout the Province of Ontario is enormous. Implements of various kinds—plows, harrows, waggons, etc., left out, exposed to rain, frost and snow! What a disgrace and what a loss to the owners! Yet many incur this disgrace and suffer the loss involved therein; and such men, young and old, often have a weakness for buying implements which they could do without, getting them on credit and wearing them out before they are paid for. Do not be guilty of such folly. Keep all your implements, waggons, sleighs and carriages under cover. Keep them in good repair; and let no one persuade you into buying what you can do without till you have the money in hand to pay for it.

4. *Attend closely to your business.* Hard work is the price of success in all honest vocations, and in these days of low prices and intensely keen competition, the man who frequents hotels or spends much time away from his farm, need not expect to succeed.

5. *Be punctual.* Punctuality is an important factor in all kinds of business; and it is to be regretted that farmers generally are looked upon as less prompt and punctual than men in commercial and professional life. Lying is among the disgraceful vices. Men everywhere resent the imputation of falsehood; and yet a great deal of practical lying is done in every-day life by persons, young and old, who thoughtlessly make promises which they neglect or forget to fulfil. Think before you make promises or enter into engagements; then keep your promises and fulfil your engagements to the letter.

6. *Make up your mind to be something more than a mere laborer.* Many farmers' sons in this Province are not making a good use of their time. Far too large a proportion of them are living very listless, useless lives, not well satisfied with their position, but doing little or nothing to improve it, going through the dreary routine of their daily life—eating, working, sleeping; sleeping, eating, working—without any well-directed effort to rise above the condition of mere laborers. Labor is honorable, and no one is degraded thereby; but human muscle alone counts for very little in these days of steam and electricity—very little in the keen competition and amidst the unceasing progress which we see in almost every line of human activity. If any of our ex-students have been dreaming in Sleepy Hollow, we would urge them to wake up, open their eyes and look around. Those who do so, will be surprised at the great changes which have taken place since they fell asleep.

7. *Observe, read and think.* In every community the educated classes are the ruling classes;

> For just experience tells, in every soil,
> That those who think must govern those that toil.

Your education is very defective and you are doing nothing to improve it. Begin to read. Nearly all great men are great readers. It is not necessary to go to a high school or a college to get an education. Some of the best educated men in the country are self-educated—self-made men; and you can acquire a good education if you will only observe, read and think. Read papers, magazines and good books. Read closely, read thoughtfully, and think over what you read. It is wonderful what a man with even one talent can do when he makes a good use of his time.

8. *Take at least one agricultural paper.* You need the information contained in such a paper. It will be of much practical value to you—value in dollars and cents; and without it you cannot keep in touch with the leading agriculturists of the country.

9. *Attend meetings in which matters pertaining to your own occupation are discussed or illustrated*, such as meetings of the Farmers' Institute, the Horse Breeders' Association, the Cattle Breeders' Association, the Sheep and Swine Breeders' Associations, the Dairymen's Association, the Creameries' Association, the Fruit Growers' Association, the Poultry Association and the Bee-Keepers' Association; also the annual Fat Stock Show, and one or two of the leading fairs—not all of these, but as many as you can, and especially those which bear most directly upon your special line of work. But do not spend too much time at fall shows to the neglect of fall work.

10. *Take some part in the affairs of your township, county and Province, and of the Dominion also.* Be not a blind follower of any party. Do your own thinking in such matters; and, if need be, sacrifice a little to put the best men into positions of trust and responsibility and to keep professional demagogues from ruling the country.

11. *Keep out of debt.* Sensible people respect the young man who wears rusty, threadbare clothes and drives in an old buggy or democrat till he gets the means to buy something better. Such a young man has a chance of success, while the one that borrows money to purchase cloths, carriages, implements, or anything else (unless in rare and exceptional circumstances) is almost sure to become a hewer of wood and drawer of water for some money-lender or loan society. Whatever you do, live within your means and pay as you go. Have nothing to do with mortgages or promissory notes. Get some interest if you can, but do not pay any.

I shall not speak to you about religion and sound morality (strict truthfulness, scrupulous honesty, etc.) as the true foundation of success on the farm as elsewhere. I assume that this important fact is impressed upon your minds from week to week.

Discussion.

The discussion on Dr. Mills' paper was very interesting, lively, and enthusiastic No less than fourteen associates and graduates of the College spoke upon the subject, and the discussion lasted for nearly two hours. The following gives a condensed report of the different speeches:

T. H. Mason, ('76), Straffordville: It was in 1874, I first entered this hall in which we are holding this meeting to-night. To be successful farmers we have to be good business men. If we wish to improve our condition as agriculturists we must make the finest possible articles of food and place them in the markets of the world in the best possible manner. Students of this College are better prepared to do this than the average farmer owing to their having an understanding of the best methods of farming operations. When a young man enters college he is usually at an age at which habits are formed which will last through life. Habits of business—being on time—learned at college are apt to stick to a young man. Young men who learn the habits of being energetic, careful, saving, and business-like in their work are the men who are going to be successful, and who will make this Province of ours what it should be in the future.

R. F. Holtermann, ('80), Brantford: If we have availed ourselves of the opportunities that are placed before us, we are certainly placed under the greatest advantages after we have gone through the course of instruction given at the Ontario Agricultural College. When we are young men, many of us are apt to make mistakes, and we must be fitted for the direct line in which we are engaging in order to succeed. We should have a high standard of proficiency before us, and do the very best in our power to reach it. President Mills advised the students to take an interest in the affairs of the township, county, Province, and Dominion. I think we should be very careful about that. A great many men who have been successful along certain lines have afterwards engaged in politics and by so doing have neglected their business and have met with heavy losses financially. It is good to be cautious.

Oscar Chase, ('82), Nova Scotia: I thank you for the honor you have conferred upon me by calling upon me, but I am no public speaker. I may say I am very pleased to be with you to-night. It is a long time since I had the pleasure of being here before. Our farming is very different in Nova Scotia from the farming in Ontario. We put a great deal of stress upon the raising of apples in our part of the Province. We find it is the most profitable part of farming. I think a great deal more could be done in Ontario in fruit raising than is done at the present time, and done profitably. I was much pleased with President Mills' paper.

T. G. Raynor, ('85), Rosehall: I would still like to be called a student. There have been great improvements made at the College since I was here for my regular course. I feel as if I would like to come back and take the course over again. I am

glad on this occasion to be present, and confer with my class mates and with other ex-students and also with the present students of the College. I was pleased with what Prof. Myers, of the United States, said this afternoon in regard to the equipment of this College in comparison to that of other Agricultural Colleges. Any young man attending this institution may receive a very profitable training for agriculture, a training that will be profitable through life. I believe we as ex-students should use our influence with the farmers of Ontario to send their sons to this institution to receive valuable instruction. I hope the students may increase year by year at this institution.

R. M. Holtby, ('86), Manchester: I am pleased to be here as it is the first time I have had the pleasure of attending an Experimental Union meeting since I left the College ten years ago. When I went in the reading room this afternoon and saw the photograph of our class of 1884-6, I could not help but think of how they are now scattered all over the country. I was much pleased with President Mills' address. We should bring business methods on the farm, practice economy and reduce the cost of production as much as possible.

Elmer Lick, ('87), Oshawa: About fifty of us came here and started the course in 1885—ten years ago, and just after the old barns had been burned. It was a dilapidated looking affair with the old walls still standing. Now, we can see beautiful buildings and excellent appliances for the teaching of agriculture. I feel like calling the place a village now as there are so many fine buildings. In referring to the class to which I belonged, I wish to make a pretty broad statement, which is, that the class of '87 furnished material which pointed out to the country that the instruction given at the Ontario Agricultural College was not only of a practical nature for farm life, but that it was of a high character from an educational standpoint. Besides those actively engaged in farm work throughout Ontario, I have only to mention that Professors J. A. Craig, G. C. Creelman, J. W. Hart and J. H. A. Morgan were members of that class. These men are now successfully filling good positions in agricultural colleges, which shows what the instructions given at this College can equip a man for doing.

A. Shantz ('88), Waterloo: I noted very carefully what President Mills said in his address to night, that "we should do much and talk little." I feel that whether I have fulfilled the first part of this advice or not I have always fulfilled the second part to the letter, and I shall do so to-night. I feel it a great honor that I have been called upon to represent our class of '88. The last speaker has just spoken of some of the brilliant lights of his class, but I feel I am representing a class far superior to all preceding ones. In the first place we were considered—and by the fair sex, mind you—the best looking lot of students that had ever entered the College. We were also considered to be the best workers on the farm, and we were a plodding class—as true as mules. Graduates of the College should be able to make a good success of their life work. At the College we get a good knowledge not only of the practical work but also of botany, chemistry, entomology and all the other sciences that are closely connected with agriculture. I would like to know who has more to do with these sciences in his every day work than the farmer.

Nelson Monteith, ('89), Stratford: After leaving this institution we must recognize the fact of increased responsibility resting upon us. This College and the staff of this College expect us to do our duty in whatever crisis we may be placed. Dr. Mills' address to night should be quite helpful to us for many reasons. The facts given by him should receive the careful consideration of each one of us.

D. Z. Gibson, ('91), Willow Grove: I was much pleased with the address of our worthy President. We as ex-students should be very careful not let our preaching get ahead of our practice. Great praise is due to the College for the opportunities afforded to the young men of the country. Students can spend their time at the College to great advantage and learn the best methods to make farming pay. I believe the ex-students are in a much better position to solve the problems of modern agriculture than others, and to pay off the mortgages on the farms when necessary.

W. D. Dyer, ('92), Columbus: The President advises the ex-students not to go into debt for implements they can do without. I think this point might be carried too far. I believe in some cases it might be advisable even to go into debt for implements providing that greater profits could be made with those implements than without them. Great stress should be placed on the Presidents advice to "observe, read and think." We should think clearly and deliberately before taking any important steps in connection with our business and thus avoid forming opinions too rashly.

J. B. Spencer, ('93), London: For a student to glean the most information from the college course, he should spend two or three years at the institution, as the first year furnishes a good foundation for the lessons taught during the second and the third years. We should be very careful not to expend more in preparing our soil than we can get back; not to grow crops except those that will give us the best returns; and not to cultivate varieties extensively, except those which have proven themselves to be superior kinds through experiment. In connection with these various points we can make great use of the Experimental Union. Some ex-students think that they have not the time to bother with experiments. This is a great mistake. The experimental work of the Union is conducted in a very careful and systematic manner and gives great advantages to those who enter earnestly upon the experiments with the object of obtaining definite and practical results.

J. F. Clark, ('95), Bay View, P. E. I.: Two years ago to-night sixty-four boys gathered around these tables to the annual supper of the Ontario Agricultural and Experimental Union for the first time. That was our freshman year. We came ignorant indeed of the scientific principles that underlie the proper practice of agriculture, save in one thing, we were proficient in the art, I may call it the fine art, of feeding, particularly on oysters, which were on the bill of fare. My constituency to-night is a large one, as I am asked to represent the class oi '95, and also the present students. The places of our nativity were, like Mrs. Hemans' "Graves of a Household," "severed far and wide, by mount and stream and sea," for we had representatives from my own beautiful Province down by the eastern ocean, where nature has been so bountiful with her gifts, and from the fertile valleys that lie between the Rockies and the sea; from the old and historic Province of Quebec on the east, and from the new and fertile prairie Province of the west; from the great nation to the south; from Great Britain, the Channel Islands, Bermuda, British India, and last but not least, from all parts of Ontario, in many respects the banner Province of the Dominion. And why did we come? We came because we believed that poverty and the headache from which I suffer to-night were not dispensations of Providence, but two of the effects of one great cause, namely, *ignorance*. We came that we might *know*, that we might learn how to win from nature, with the same expenditure of capital and energy, a *better* and *larger* return; and not only that we might become better farmers, but better *citizens*, better *men*. We found a college suited to our needs, a college where, while we studied scientific agriculture theoretically in the class-rooms, we might learn the practical part in the fields; a college where, while we attained a love for the study of science and the acquisition of knowledge, we retained our love for the old homestead and the farm; a college where we learned how we might make the lovely home more lovely; how we might make that happy home life still more happy. Since we have come there has been very marked progress. A number of new buildings have been erected and fully equipped, and now the College is very fully equipped for its present needs along these lines. Never was the College so well manned as regards its staff as it is to-day, and I feel perfectly safe in saying that, although there may have been times when there were more brilliant students within these halls, there never was a time when there was a larger percentage of the students who were in earnest to improve themselves, not only in the class-rooms and in the fields, but in the Y. M. C. A., literary society and on the campus. In considering this great progress, it is not strange that I should dream of still greater progress in the future. I dreamed a dream, and this is what I dreamed. It was 1950, A.D., and I again visited this place and I did not know it. Great buildings now unthought of adorned the campus to provide accommodation for the greater work of

the College. The attendance too, was changed; some eight hundred students found a home in the halls; for the Ontario farmer had at last awakened to his *necessity* and to his *opportunity*. On entering the halls, no smell of coal gas greets us, for I learned that the lighting as well as the cooking was done by electricity. I also learned that electricity had replaced all other forms of motive power on the farm and in the buildings. Indeed I presume that the Professor of Veterinary Science would have to lecture before his class with a stuffed specimen of the equine species when demonstrating the various anatomical peculiarities of the former means of locomotion. There was another thing that was to me particularly striking, and it was what they told me was the Cooking School Department. They also told me that some two hundred of Ontario's rural daughters were there learning the art of cooking and kindred arts. I was also told that many ideal homes were to be seen springing up here and there over the Province. I do not doubt it, for in my hunt for *ideal* homes, where should I expect to find one, if it would not be in some quiet rural place where a graduate of the O. A. C. was at the head of the house, and who had for his companion a graduate of Ontario Agricultural College Cooking School. So indeed were all things changed that could be improved, but there was one thing that could not be improved. It changed not. It was this. As I retired that night I thought I heard a familiar step in the corridors, and I heard a sound. What was it I heard? This is what I heard "All lights out—gentlemen —please." Faithful John still walked the corridors in the second century of his janitorship.

The following comment upon the speakers who took part in the discussion on Dr. Mills' paper occurred in one of the Guelph papers on the day following the meeting: The speakers were certainly an honor to the College, and no better tribute to its work could be given than the progressive and representative young agriculturists whose interest in their alma mater was so deeply manifested.

SCHOOLS OF DOMESTIC ECONOMY AND THEIR ADVANTAGES.

By Miss Bessie Livingstone, Ottawa, Ontario.

A school of domestic economy is an educational institution where practical instruction is given in all the household arts and theoretical instruction in all the sciences which bear directly upon the home life.

The first institution of the study of any branch of household science, in connection with a school or college on this continent, was in the year 1877 when, on the advice of Professor Bragdon, a department of practical instruction in cooking and sewing was inaugurated in LaSalle Seminary (near Boston.) It was the outcome of a feeling that a purely intellectual culture failed to fit woman for the discharge of the home duties which she is called upon to fill, and that, in order to cope with the perplexing social conditions which have been the problem of every nation, and particularly of this new and growing country, a technical knowledge of the details of every day home life is essential.

The trend of popular education has been chiefly along intellectual lines; few colleges now remain closed to women. In the pursuit of science and art every opportunity has been afforded them, but in Canada what provision has been made for the pursuit of the science of housekeeping? This science which is the oldest and most important has been generally looked upon as a knack which women possess intuitively, requiring no systematic instruction by specially qualified teachers. This opinion is no longer held by the educators of other countries.

It is now many years since attention began to be paid to this important branch of nstruction is Europe. If I mistake not, Sweden was the first country to establish chools for the teaching of domestic science, but Finland, Holland, Germany, France and

the British Isles have followed closely in her wake. At first the desire was to improve the condition of the homes of the uneducated classes, and the pioneer work was chiefly in giving practical lessons in economical, healthful cooking, and object lessons in neatness; now the movement is recognized as one of vital importance in its relation to national and individual life and prosperity.

Our sister country across the border has been quick to profit by their example, and that a deep interest is taken in the subject is testified by the complete course of instruction in household sciences and economics which is given in such institutions as Wisconsin University, Pratt Institute, Brooklyn; Armour Institute, Chicago, and many others, and its introduction into State industrial and public schools shows the light in which it is regarded as an educational factor of the nation.

In many of the state agricultural colleges girls are admitted on an equality with boys in the study of botany, entomology and other sciences of value in practical life, and while the boys are being instructed in agricultural science, the girls receive practical and theoretical training in the sicence of housekeeping.

The instruction given in such a school includes a course of training in household management. This is given by means of lectures on such topics as: "The Systematic Daily and Weekly Routine of Work," as in sweeping, dusting, care of living and sleeping apartments, lectures on laundry work and general cleaning and care of the house from "attic to cellar." The purchase and care of family supplies, the keeping of household accounts, marketing, etc. This knowledge is practically applied, as the housework of the school-boarding department is done by the pupils, each one being required to spend a certain period every day for two weeks in different departments of housework, so that at the end of the term the pupils have had the practical experience of systematic household management and labor, and all this under the supervision of a fully qualified teacher.

Instruction is also given in home sanitation, by means of lectures on topics such as: The situation and care of the house, its surroundings, plumbing, draining, ventilation, heating, lighting, furnishing, and clothing; in a word how to secure and maintain right sanitary conditions—subjects of greatest importance in their bearing on the health of the individual and family. In these, women should be educated in order to properly care for those committed to their charge.

A useful training is given in home nursing, emergencies, and hygiene, the aim being to teach women how to care for sudden illness and accidents and to intelligently follow a doctor's orders when trained assistance is not to be had.

The studies of foods and dietaries is perhaps the branch to which special attention is given. The pupils plan and cook all the meals served in the school and receive daily instruction in: The classes and kinds of food material, vegetable, animal, and mineral, with special reference to their relative importance, modes of preparation, preservation, etc., the selection of food with regard to cost, value, suitability—to season, age and occupation and condition of health. In addition, the student is trained in the economical expenditure of a weekly allowance by being obliged to purchase all supplies for the school.

Special attention is given to the serving of nutritive, attractive, and varied bills of fare for different seasons. The scientific side of the food question is also taken up. The chemistry of foods, composition of foods, chemical changes in the cooking and digesting of foods, effect of light, heat, and air upon food, composition of the body, and the laws which govern it are all subjects for consideration.

The aim of these schools is to give women a special training for their work in home life, as that is the occupation which the majority of women are called to engage in, and which most of them prefer above all others, and it is a duty which, if properly performed, is of greater importance in determining the health, wealth, and happiness of a nation than the duties pertaining to any other calling in life.

We have been a little behind the times in Canada, for there is not a thoroughly equipped school in the Dominion. Good work is being done in some departments of

domestic science by the Young Women's Christian Associations of Montreal, Toronto, Hamilton and Ottawa, which are also extending this work to surrounding towns and country, by means of demonstration lectures on cookery, and the keen interest which the introduction of the preliminary work has awakened shows that the day is not far distant when the subject of domestic economy shall be an essential feature of our educational institutions.

The advantages of such an education to Canadian women would be invaluable and particularly to the farmers' daughters, as it tends to remove the feeling of monotony and drudgery so frequently associated with housework; and if in addition to all the other subjects a course of instruction were given on such profitable and interesting topics as beekeeping, poultry raising, fruit raising, and kitchen gardening, the question of "How to keep the girls at home" would be easily solved.

A course of study in the science of living will, I believe, produce as gratifying results in our Canadian homes and people as the investigations and study of scientific farming have done for Canadian farm interests.

THE HONOR ROLL OF 1895.

"Honor to whom honor is due."

C. C. James, Deputy Minister of Agriculture, Toronto.

We stand to-night at the parting of the years, between the old and the new, near the close of the nineteenth century. The young men of this gathering, interested in the development of the oldest of the arts and the newest of the sciences, are looking for light, for information, for guidance. This Union has been formed to carry out experiments, so that from the present and the past a better future may result. You will hear much about experiments with grains and grasses, with bees and stock, and in dairy operations. I propose to review for you some experiments of a higher kind, different somewhat from most of those that you are accustomed to consider but quite as important. With the planning of these experiments you had nothing to do, but with the results you are much concerned —they are taught in your lecture rooms, read in your books and periodicals, and applied in your practice. They are experiments that you can imitate in your lives, in your studies here, in your life work afterwards. They are experiments that cover almost the entire century; they have all closed, in one sense, during the past year. I shall choose six only, five of which ended within a period of six weeks, and I challenge you to produce six others more important, more interesting or more noteworthy in any century. They are experiments in right living, experiments in beneficence, experiments in the higher humanity. They are the records of six men who have laid aside their work for agriculture during the past year and who have passed to their reward, whose monuments are an improved agriculture and of whom the great common people of the world can say "Well done!"

The first upon our list is Amos Cruickshank, of Sittyton, Aberdeenshire, Scotland, who died on May 29th, 1895, at the age of eighty-seven. To men brought up and living in the town and city it may be necessary to explain who the Cruickshanks were. To them the name suggests George and Robert Cruikshank, the caricaturists, and if they turn to biographical dictionaries they will not find the names of Anthony and Amos, though George and Robert will there be duly given places of honor. But to students of the Ontario Agricultural College and to the stock raisers of this Province and of this continent, Amos Cruickshank is known as one of the greatest benefactors of Scotland, of England, of the United States, and of Canada. When the names of many politicians at the present day prominent in British newspapers shall have disappeared and been forgotten the names of Bakewell, Colling, Booth, Bates and Cruickshank will be placed alongside of Arkwright, Watt and Stephenson as those who truly laid the foundation of Britain's wealth and prosperity. When the day comes for reckoning up the growth of British wealth the development of the great pure-breeds of stock will have to be considered, and the names that I have just mentioned will be given an honorable place.

If from old London as a centre you describe a circle with a radius of about 400 miles you will enclose England, Ireland and Scotland, the Channel Islands, Holland and Belgium and a large part of France and Germany. Leaving out the water areas, you will take in about 350,000 square miles of land, a district only one-half larger than the Province of Ontario. And yet within that comparatively small area there have been originated at least four-fifths of all the modern pure breeds of stock—in cattle the Shorthorns, Herefords, Ayreshires, Galloways, Polled Angus, Devons, Kerries, Red Polls, Jerseys, Guernseys, Normandies and Holsteins; in sheep practically all the breeds except the Merino; in horses the Clydesdales, the Shires, the Thoroughbred, the Hackney, the Suffolk Punch, the Cleveland Bay, the Percheron; in swine the Berkshire, the Yorkshires, the Essex and the Tamworths.

We notice further that most of these breeds arose in England and Scotland, and of them all the Shorthorn or Durham breed of cattle, will by many be considered the greatest. Bakewell (1725 to 1794) developed the Leicester sheep and the Longhorn cattle. He died almost in poverty, after amassing and spending a fortune. But he left an impression, an example that gave a new life to the agriculture of the world. Bakewell had succeeded better with sheep than with cattle. Then came the two brothers, Charles Colling and Robert Colling, of Durham County, who began to improve the old Teeswater cattle and developed what we know as the Durham or Shorthorn. We are told that Charles Colling's stock sold in 1810 at an average price of 175 guineas. The Collings retired about 1820. The Shorthorns were then developed into three great families or strains—the Bates, the Booth and the Cruickshank. Thomas Bates built up his herd at Kirklevington, in Yorkshire, from 1810 to 1849, and has to his credit the long list of Duchesses. Thomas Booth began his herd at Killerby and Warlaby, in Durham County, in 1790. His son Richard went to Studeley in Yorkshire and got together a fine herd, which was sold in 1834. In 1835 he inherited his father's Warlaby estate and continued as one of the most successful breeders until his death in 1864. In that year his nephew, Mr. Thomas Christopher Booth, came into possession and continued the good work of improvement until his death in 1878. To show the enterprise of Mr. T. C. Booth it may be mentioned here that when foot and mouth disease played havoc with his fine herd he bought 12 females, descendants of his own stock, for 11,545 guineas. Since the death of Mr. Booth in 1878, the herd and estate have been under the direction of trustees. The youngest heir has come of age this year; hence the great Warlaby sale of June 22nd, when 48 head were sold for $31,620. It is stated that the son will continue the work, and that a new Booth herd will be built up from the reserve of the Warlaby dispersion.

And now as to the third Durham benefactor, Mr. Amos Cruickshank. In 1837, he and his brother Anthony came down from the far north to Durham and bought a shorthorn heifer. Sittyton gradually became famous and in time drew buyers from England, the United States, Canada, in fact from every part of the English-speaking world. Amos Cruickshank was a Scotchman, of the very best type. Mr. Wm. Duthe, of Aberdeenshire, a friend and follower of this pioneer, wrote about him in December, 1894, thus: "He is really a wonder—so fresh and clear in mind and memory, and so loyal in spirit to God and all that is good, with that quietness of manner and unassuming speech that is apt to conceal from a stranger the strong intellect, the mature judgment and the high principle which combine to form such a noble character."

The farmers and stockmen of Ontario have gained much from the work of Bates, the Booths and the Cruickshanks. They have been benefactors of the whole world, and though titles and monuments in Westminster have not usually been given to such as they, their work will some day be appreciated when others more noisy and more clamorous shall have been forgotten.

There are many herds in Ontario and in the United States that have been built upon Cruickshank blood, and during the past season English buyers have paid a high compliment to Scotch breeding by going north and bidding high prices for Scotch Shorthorns to improve their herds. The great sale of the past year may be mentioned when Mr. Duthie, of

Collynie, and Mr. Marr, of Uppermill, sold forty-seven Shorthorn bull calves for $14,000, an average of nearly $300 a head. One calf, eight months old, was sold for 235 guineas to an Englishman. Mr. Amos Cruickshank, as I have stated, died May 29th, 1895, at the age of eighty-seven. For nearly sixty years he had carried on his work in that northern country; he had worked in a quiet and unostentatious manner, but with such success that Cruickshank blood has found its way to the Royal stables. The story of his life, of his slow but sure methods, of his thorough-going honesty, should be known by every farmer's son. He had many difficulties to contend with, and his location was not the most favorable, but he proved to the world that after all it is what is in a man, rather than what is around him, that decides his fate. A large portion of the stock wealth of Ontario is traceable back to Aberdeenshire, and we pay our humble but sincere respect to the memory of "the grand old man of Sittyton."

Hermann Hellriegel was born at Anhalt, Germany, in 1831, and died in October, 1895. Who was he, and what did he do? In the announcement of his death to the National Society of Agriculture, at Paris, of which he was a foreign member, it was said that he was "the immortal author of the discovery of the fixation of gaseous nitrogen by leguminous plants through the medium of their root nodules." Remember that this was said by a Frenchman in regard to a German. Science knows no distinction of race or boundary lines; it tries to forget the siege of Paris. To place his great discovery, made in 1868, in its true light, we must review rapidly the history of the nitrogen question. In 1838 the French chemist Boussingault published the results of his investigations into the mode of plant feeding. He concluded that plants were unable to assimilate free nitrogen. From 1849 to 1856 another French chemist, Ville, carried on a series of experiments whereby he concluded that some plants do absorb free nitrogen from the air. The question now became a live one; the scientists of France, Germany and England ranged themselves on two sides, and year by year waged a battle royal over this important question in agriculture. In 1877 Schloesing and Muntz proved that nitrification, or the forming of nitrate in the soil, is the result of the work of microscopic organisms. There was still a perplexing question to be solved—these nitrates are most important in the feeding of cereals, but played no part, had no effect in promoting the growth of such plants as clover, peas and beans (leguminous plants), although the latter contained in leaf, stalk and root much more nitrogen than the cereals. What was the explanation? In 1886 there was read before a meeting of German naturalists at Berlin a paper containing investigations by Hellriegel and Wilfarth, in which they proved conclusively that the nodules on the roots of the leguminous plants were filled with micro-organisms (bacteroids), and these in some way help the plants to obtain free nitrogen from the air. The great importance of this discovery, its confirmation of one of the practices of agriculturists and the importance of its application are so well known to students of agriculture that we need not dwell upon it. This nitrogen question is one of great interest to the scientist and of great value in practical agriculture. Plants grow in a great ocean of atmospheric nitrogen, but, Tantalus-like, they are unable to drink the draughts that touch their very lips. The production of nitrogen compounds in such forms as plants can assimilate is one of the chief aims of drainage, cultivation, green manuring and fertilizing, and the rotation of crops. The foremost chemists and biologists of Europe and America have for nearly a century been engaged upon its study, and among the successful contributors to the solution of this question Prof. Hellriegel takes a foremost place, and at his death we deem him worthy of a place on our Honor Roll.

Charles Valentine Riley, was born at Chelsea, London, England, on September 18th, 1843, and died at Washington, U.S, a few weeks ago. He was therefore but fifty-two years of age, the youngest of the noble benefactors whom we commemorate, but his comparatively short life was crowded with industry, and many results have followed that have benefited not agriculture alone but the people of America as a whole.

After receiving a fair education in England and on the continent he came to America in 1860 at the age of seventeen. For four years he lived on an Illinois farm, whence he went to Chicago as entomological editor of the *Prairie Farmer*. In 1868 he was appointed State Entomologist of Missouri, a position that he held for nine years. The

nine annual reports that he issued from this then wild western state, attracted the attention of the scientific world. Darwin congratulated him, and *The Entomologist's Monthly Magazine* of London, in 1876 referred to him as "the foremost economic entomologist of the day." From Missouri he went into the service of the Federal Government, being first chief of the United States Entomological Commission, and shortly after Entomologist to the United States Department of Agriculture. He resigned his position during the present year, and soon after met his death from being thrown from his bicycle.

What of his work? He suggested to the French Government a prevention for the Phylloxera that was devastating their vineyards, viz., the use of American stock for the vines, and was awarded a gold medal as a special honor; along with Dr. W. S. Barnard he devised the cyclone nozzle for spraying; he worked out the life history and locations of the periodical Cicadas, both seventeen-year and thirteen-year; he contributed reports upon the scale insects, hop-plant louse, and a thousand and more other insects that are to day the works of reference of students of entomology in all countries; and he was the principal leader in brining the economic entomology of America and of Canada to the place which it occupies to day, the first place in the world. But one story connected with his life-work is worth telling in greater detail. About 1868 a scale insect known as the Cottony Cushion scale (*icerya purchasi, markell*) gained a footing in the orange groves of California. It increased steadily until in 1886 the citrus groves were in danger of complete destruction and the fruit growers were in despair. Prof. Riley began the study of the pest. He ascertained that it had probably come from Australia, where it was held in check by other insects. He appealed to Congress for financial aid and was refused. Nothing daunted, he induced the Secretary of State to allow him to send two of his assistants to the Melbourne Exposition then in progress. They went and sent back consignments of an Australian lady-bird beetle (*Vedalia Cardinalis*). This was in 1888. Prof. Henry of Wisconsin was in California in 1889, and he reported the result as miraculous. He said "Without doubt it is the best stroke ever made by the agricultural department at Washington." The Australian lady-bird beetle has almost anniliated the scale. The experiment cost not over $2,000; it has saved and added to the country millions of dollars. No one need ever question the practical bearing of entomology upon agriculture. The prosperous fruit industry of California is one of Riley's lasting monuments. Let me close this brief memorial of this great man who has been honored by the entomological societies of Great Britain, France, Germany, Belgium, Switzerland, and Canada, by a few words from one of his friends and associates, Prof. C. S. Packard, of Brown University (*Science*, December 6th, 1895, p. 745) "Biologist, artist, editor and public official, the story of his struggles and successes, tinged as it is with romance, is one full of interest. Beginning life in America as a poor lad on an Illinois farm, he rose by his own exertions to distinction, and to become one of our most useful citizens in science, both pure and applied. His nature was a many-sided one and his success in life was due to sheer will power, unusual executive force, critical judgment, untiring industry, skill with pencil and pen, and a laudable ambition, united with an intense love of nature and of science for its own sake. This rare combination of varied qualities, of which he made the most, rendered him during the thirty years of his active life widely known as a public official, as a scientific investigator, while of enonomic entomologists he was *facile princeps*."

Dr. Ephraim W. Bull was born in Washington street, Boston, March 4th, 1806. In the garden about his house he began his study of nature. In 1832, through ill-health, he gave up his practice as a Boston physician and moved out to Concord. Reports differ as to how the Concord grape originated. Some say it was a chance seedling in his garden, others that he found it in the woods. It was exhibited at the annual exhibition of the Massachusetts Horticultural Society in 1853 and gained a $100 prize offered by Horace Greeley for the best native grape suited for general cultivation. From the Concord have come many other famous grapes, among which it may be mentioned the Niagara, Pocklington, Worden, Martha, Lady Washington, Jefferson, Moore's Early, the Brighton, the Diamond, and the Esther. Dr. Bull himself says of the Esther: "I have long cherished the desire to name the best grape after my mother, and I have called this one by her name because I feel it is as near perfection as I shall ever attain." He reaped little

pecuniary reward from his valuable work, he was reduced to poverty in his old age; friends sent him some assistance, but the last two years were spent in a charitable home, where he died in his ninetieth year.

When we remember that the Concord and the Niagara are the two greatest wealth-producing grapes of eastern America we can realize the value of the contribution made to horticulture from the work of this man. He had been at one time a Senator of his native State, he had been a respected and valued member of the Massachusetts Board of Agriculture; he had been the intimate friend of the Concord philosophers—but he outlived them all and died a poor man—poor in worldly possessions, but rich in the respect and estimation of the people.

Louis Pasteur: The greatest genius of the nineteenth century, one of the greatest benefactors of the human race.

Louis Pasteur was born December 27th, 1822, in Tanners street in an obscure village of Jura, (Dole), in eastern France, in sight of the Alps. His parents were, as we say, obscure. His father, Jean Joseph Pasteur, was a journeyman tanner. He had fought with the French army in Spain from 1811 to 1815, and then resumed the humble but honest calling of a tanner. He had received little or no education, but a friend of the family says "If he had received an education he would have made his mark." The son Louis received a good education, passing from school to school until finally he reached the *Ecole Normale Supèrieure* in 1843. He was a good student, not brilliant, says his college chum, Jules Marcou, of Harvard, and he began to drink in the lectures on chemistry and sit enraptured at the experiments performed by the skilful old man who assisted the lecturers. Marcou says: "I have seen him, at the end of some of those lectures with his eyes filled with tears, ready to cry, so much was he moved by what he had heard and seen."

In 1846 he was appointed assistant in chemistry at the Normal School, and his career of usefulness began. His fifty years of marvelous discoveries can be sketched only in outline and reference made to only those that appear to be the most important. He steadily advanced in his work, moving from Paris to Dijon, thence to Strasburg where he was married, thence to Lille in 1854. He now began his work upon ferments. Working with his microscope he found various fermentations always accompanied by the presence of certain living organisms. Liebig, one of the founders of agricultural chemistry had propounded a theory of fermentation based entirely upon chemical decomposition. Pasteur was a chemist, not a biologist, but he undertook the new field and thoroughly worked it. He investigated first the fermentation of milk and then of wine, and he proved conclusively that living organisms are the cause of fermentations. In 1866 appeared his memorable work upon the study of wine (*Etudes sur le vin, ses maladies, etc.,*). The wine industry was in a languishing condition. He determined how to check the diseases of wine by heating, the method since known as Pasteurization, and how to promote the proper fermentations. He saved the great wine industry of France, and established the principles whereby wine is now made the world over. He made possible the production of vinegar on a cheaper plan. He laid the foundation for dairy bacteriology; in fact, we may say that he originated the whole science of bacteriology which is playing so important a part in the study of dairy products, of the preservation of food, of the production of food, and even of the make-up and changes in the very soil itself. This alone would be sufficient work to immortalize any man, but we must remember that it was practically the outcome of the first work of Pasteur done between the ages of thirty and forty. We have not time to refer to the controversy whereby Pasteur in France and Tyndall in England proved that spontaneous generation is an impossibility. Even theology received an impetus from his work.

In 1850 a disease of the silk worm appeared in France, and by 1863 the annual product had been reduced from 57,000,000 pounds to 8,000,000. This industry was on the point of extinction. Even the Emperor, Napoleon III., was concerned. Pasteur was appealed to. He consented to try, although he knew nothing of the industry. For five years he worked, and in 1870 published "Studies on the disease of silk worms." He

had solved the problem, and saved one of the greatest industries of France and the peasants were his ardent worshippers.

The Franco-Prussian war had driven the German brewers from France and brewing was on the decline. After recoving from an illness that almost cost him his life but left him a partial invalid for the rest of his days, Pasteur settled down from the turmoil and disquietude of the war and began the study of beer and brewing, and in 1876 published his "Studies on Beer, its diseases, etc."

His genius now took a higher flight. The herds and flocks of France were being decimated by the terrible disease, anthrax. He now became a physiologist and worked over the whole history and cause of the disease from the beginning. He brought his exact training in chemistry to bear upon a work in which speculation had played an important part, and after mastering fowl cholera he gave the world anthrax vaccine, and with his own experiments demonstrated to a delighted and astonished scientific world that anthrax can be controlled and prevented.

He saved the herds and flocks of France, but human life is held of higher value, and the recent discovery of anti toxine in the case of diphtheria is an outcome of his method of investigation and procedure. We all remember the marvellous story of his treatment of hydrophobia. Contributions from enthusiastic admirers were offered, and the Pasteur Institute, with its magnificent equipment, arose in Paris, which became the Mecca for hydrophobia patients. Our story of this great man, this master mind, is about told. He died September 29th, 1895, and was buried with national honours. The President of France, the senators and the common people, followed the funeral car of the man who had saved the flocks and herds from disease, who had brought back the silk industry of the peasants, who had re-established many of the great industries of the town and city, who had made possible the wonderful achievements of modern surgery, and laid the foundation for the magic science of bacteriology. He gave France and the world millions upon millions, and he took in return but $5,000 a year for himself and his family after him. Eliza Priestly, writing of his work in *The Nineteenth Century* for June, 1888, said: "If Pasteur had chosen to keep 'his secrets' to himself, and to sell his scientific wares, he would by this time have been the richest man in the world; but now at the end of a long career he is simply what he was at the beginning—a professor of chemistry, in receipt of a professor's salary." Let me quote the words of one of his followers, Prof. Conn: "No man who has lived in history has done so much for humanity. No other person will be remembered by posterity as having had such an influence upon the world in the way of discovering facts which advance the health and prosperity of mankind." But perhaps the proudest achievement he attained, viewed from the standpoint of a scientist, was earning the right to the claim that Prof. Conn has applied to him, "Pasteur never makes mistakes." The French papers gave his will as follows: "This is my testament. I leave to my wife all that the law allows me to leave her. May my children never depart from the path of duty, and always have for their mother that love which she deserves."

Last on our list comes the veteran Rev. Lorenzo Lorain Langstroth, or as he has been respectfully and reverently known for so many years, "Father" Langstroth, who died October 6th, within six weeks of being eighty-five years of age. He was born in Philadelphia on December 26th, 1810. He graduated from Yale in 1831, and, after acting as tutor at his alma mater for a short time, entered the ministry at Andover, Mass., in 1836. In 1840 through ill health he resigned, and varied his life between teaching, preaching and out-door work. In 1838 he started as a beekeeper with two hives. Year after year he worked with his bees in spare hours after teaching. His apiary was in the attic of his Philadelphia home. The Bevan bar hive was then in use. Bars or strips of wood were laid across the top of the hive to which the bees attached their cells, and when it was desired to remove the comb production the honey had to be cut away from the sides. Thus the bars could be lifted out with their load of sweetness attached. Langstroth added bars to the sides and bottom and the movable frame was originated. It was patented in 1852 but the inventor was beset by law suits and never reaped any pecuniary reward. But the beekeepers of the world were enriched, and wherever the modern hive is set up there we find a monument to the memory of this

venerable benefactor of mankind. His health failed, and he retired from active work. From time to time he returned to his favorite pursuit, only to enrich the field of apiculture. In 1853 he published his book, "The Hive and Honey Bee," which has become the beekeeper's cherished classic. In 1858 he removed to Oxford, Ohio, and in 1887 he settled in Dayton, of this same state, where he remained. In 1892 appeared his "Gleanings in Bee Culture." His latter years were not spent in luxury or even in favorable circumstances. He died a poor man. In September of this year he came to Toronto to attend the annual meeting of the North American Beekeepers' Association, and his presence was the greatest attraction. On October 6th he was assisting in the communion service at a Presbyterian church in Dayton when he was suddenly overtaken by death.

Mr. A. T. Root, of Medina, Ohio, one of the foremost apiculturists of America, and a pupil of Father Langstroth, pays this tribute to him :

"He was a wonderful talker as well as writer,—one of the most genial, good-natured, benevolent men the world has ever produced. He was a poet, a sage, a philosopher and a humanitarian, all in one; and best of all, a most devoted and humble follower of the Lord Jesus Christ. His fund of anecdotes, pleasant memories and incidents was beyond that of any man I ever knew, and his rare education and scholarly accomplishments only added to it all."

Father Langstroth lived a long life of usefulness, he gave his energies to the development of a very important branch of agriculture, he enriched an industry that is almost as old as the human race; and he was not selfish, for he gave more than he got. During the last years of his life donations to his comfort were made by his many friends, and he went away from Toronto richer by the hearty contributions of his loving friends. The last thing we shall say of him is that he was loved best by those who knew him best.

Let us draw our conclusions.

Scotland gave us Cruickshank; England, Riley; Germany, Hellriegel; France, Pasteur; and America, Bull and Langstroth. But they gave them to the world, for the results of their work are known and appreciated and applied in every civilized country where agriculture has got beyond its primitive condition. We may fairly challenge any other year to produce six such men.

The review of the work of these six men proves most conclusively that within the past century agriculture has made wonderful progress, it has been raised to a higher level. Where will agriculture be at the close of the twentieth century? Who then will be recalled as benefactors? Will there be enrolled in the list of agricultural reformers anyone from this Canada of ours, anyone from this Agricultural College, anyone from the gathering in this room to-night? It is quite possible; let us hope that it may be so. These men all rose from obscurity; they had difficulties to contend with just such as you have; they were no better at the start than you, but what grand use they made of their opportunities!

They did not seek for wealth or fame or glory in the fields of military life, of politics, or of commerce, but in agriculture, in agricultural chemistry, in biology, in allied physiology, in entomology, in horticulture and in apiculture,—in those fields that lie close to the foundations of a nation's prosperity,

They were generous and unselfish, they made the world richer. Two died in comparative poverty, the Scottish breeder was probably the richest of all at his death—and yet their work has resulted in adding millions annually to the wealth and comfort of the world.

They were not all physically strong. Dr. Bull gave up his practice at twenty-six because of ill health, and then lived to be nearly 90; Langstroth was more or less an invalid, but rounded out eighty-five years; Cruickshank was eighty-seven; Pasteur, after being partially paralyzed for many years of his greatest success, died at seventy-three; Hellriegel was sixty-four; and Riley, by an unfortunate accident, was cut off at fifty-two. They were not specially gifted with strength, but their combined ages were 451, an average of seventy-five.

Though you will find only two of the six mentioned in the new Century Cyclopedia of names, and that to the extent of nineteen lines in all, yet when history comes to be written in fairness and in greater truthfulness you will find these men holding honored places when many whose names now occupy a large place in the public press have been utterly forgotten.

Finally these men lived lives of honesty, industry and of true reverence, and the world is better morally for their having lived. As students of agriculture, anxious for the improvement of our calling and our country's prosperity, it is our opportunity to honor them, it is our privilege to enjoy the benefits of their work, and it is our duty to emulate them in those qualities that made them useful, great and good.

ADDRESSES BY VISITORS.

Colonel Burch, Editor American Sheep Breeder, Chicago, Ill.

The President of this magnificent institution and the young men connected with it should advise the Government of this Province to establish a ladies' department or a cooking department in connection with the college. I like Ontario well, and I like your institution here both as a school and for its experimental work. I believe it cannot be surpassed on the American continent unless it is with experiments in sheep raising, in which work I believe Prof. Henry and Prof. Craig beat the world. Prof. Craig is a leader in his line of investigation, and I do not know whether he was born in the United States or in Canada. The United States is a good place to be born in. It is a good place to immigrate to. The most enterprising city in the world is Chicago, and we have got there fifty thousand Canadians, and thirty thousand of them, Mr. President, are from the fair Province of Ontario. We would be pleased if we could get thirty thousand more. I do not want to take all the boys over there. Chicago is no better than here in very many respects, and in many things not so good. You have a magnificent field here in which to place your young men at work.

I may say that Ontario is the nursery for fine women, where ladies on the farm are every day brought in touch with everything that is beautiful. I have been over Ontario for two straight months at a stretch and mostly with farmers. I have been in half a hundred Ontario farm homes and have found good living, books, magazines, flowers and art and the dozen and one things that go to make homes happy. It is not very much trouble to love the ladies in such homes as these.

I congratulate the members of the Ontario Agricultural College upon the excellent work being done. I had the pleasure and the privilege last summer of examining your experimental work in company with your enterprising experimentalist, Prof. Zavitz, who is at the head of this experimental department. What I saw in connection with this department was a revelation to me. I never saw anything to equal it before—magnificent demonstration of practical experimental work. It was certainly a revelation to me. I want to have Mr. Zavitz over the line, and some day we will have him by a big salary ; you can bet your life on that. We have got some of your men already. From the experimental department I went to the dairy department, and saw in the practical dairy work the evidence of high art. I do not wonder any longer that you came up to Chicago and captured all the prizes.

Mr. Chairman and President, this is a splendid occasion—grand one. Young gentlemen, you are here as freshmen and juniors and seniors, and some of you I have shaken by the hand and have been pleased with the opportunity. I want to tell you this particularly, that you should profit by your instruction at this institution, such an opportunity comes but once in a lifetime. Some time ago I was to deliver an address as substitute for Fred. Doyle in a small town in Michigan. His secretary met me at the station. It was a day when the wind was in the north-west, and the fierce blasts were

sweeping everything before them. As we walked along I noticed a paper whirling around in front of us for about a block. I said there is something on that paper, and in an instant his foot was on it and it was soon picked up. The first thing I noticed was an advertisement on one side of it and on the other side it read: "Lost, yesterday, somewhere between sunrise and sunset, two golden hours, each set with sixty diamond minutes; no reward is offered, for they are gone forever." And now, young men, here is your opportunity to make Ontario magnificent and prosperous. You have a splendid country with all its rich resources and agricultural advantages, and above all you have splendid men. How I like to look at Canadian sons. There is so much frankness; so much freedom; so much study of purpose. The American is always on the wing, he is a speculator, he is never satisfied to stay at one place, he wants lots of business, he is always in a hurry to get righ, he is nervous, anything he has is for sale.

You have good government. Your cities are the best governed cities I have visited. Toronto, London, Guelph, Chatham, Brantford, Hamilton, have all got splendid government—protection, love, authority. I admire you for it. You are now in possession of one of your greatest men as your Minister of Agriculture. He is enterprising, energetic, enthusiastic in his great work.

I want to offer from my heart of hearts this little sentiment: Your gracious sovereign, Queen Victoria, Queen of Queens; may she live to be a hundred years old and rule over the greatest empire the world has ever seen.

PROF. J. A. MYERS, DIRECTOR AGRICULTURAL EXPERIMENT STATION, MORGANTOWN, WEST VIRGINIA, U. S. A.

I have listened to your exercises with a great deal of pleasure and interest. There are many things that have impressed me very much, and I want to say that I propose to go home and recommend that we establish a professorship of soup, and establish a "fire department." Now you may think I am talking fun in the presence of our friend here, Miss Livingstone. I only assume it in this way. There is a great deal in this education of our girls and our young men for the affairs of life. A good professor of soup in New York city in any of its first-class restaurants or hotels can command a larger salary than I presume you pay to the president of your institution. You go to the Fifth Avenue Hotel and you will find the professor of soup there gets $10,000 a year, and has a vacation of three months to go to Europe and visit the various hotels and restaurants in France and Germany. So you see that is a department of industry that requires a considerable amount of attention. Any of you who will go to that high degree of excellence will find ample fields open for you. They apply a more eloquent title to professor of soup by calling him the *chef*. You may think that we Yankees over there do not cook right; that we do not get enough to eat, and what we do eat we do not eat it right. Now, gentlemen, I want to say that for the first five years of my life I was starved, I never had enough to eat, but I have this advantage, I digest everything I do eat. I never tried it, but I could digest a nail if I could eat it. Now your president gave you some excellent good advice this evening. I listened to it with a great deal of pleasure, but he missed some things; he did not have time to cover everything. One of those he missed is this: "Be sure and do not attend to other people's business." I have seen more prople get into trouble by attending to other people's business than in any other way. There is another thing: "Do not neglect small matters." We are apt to go through life failing to see a good many of the small points as we go along. There is another point the president missed. I will excuse him for it as this is just a little one that is of a very serious character. You young men who are going out of the College bear this in mind: embark out fully equipped for life, and the first thing to do after graduating from College is to attempt matrimony and be married just as soon as you want to, and come to the United States and live.

GEO. E. CASEY, M.P.

Mr. President, ladies and gentlemen: I am very much ashamed of myself for the fact that this is the first time I have visited this great College in the Royal city of Guelph, I am sorry I have not had more time to-day to see the wonders of this institution and more time to-night to say what I think about them. You can imagine my position at this hour of the night. I think we should feel greatly indebted to our friends from the United States for the gentlemanly and gracious manner in which they have spoken of Canada and this institution. The Government can provide for the people of the country opportunities of education, for all the duties of life, and the graduates of this Institution should be of help to the country. The Government has done her duty nobly; I say it with pride, for I am proud of Ontario for taking up agricultural edueation and, without regard to party, in the carrying on of this institution. What has sprung from it? I am proud of the grand success of the agricultural education and of the agricultural industry. I am proud to find young men, graduates of this institution taking up and carrying on work of this Agricultural Experimental Union, and making it of so much benefit and use to the community at large. It is the co-operation of graduates. It is a pleasure to see the young men taking such an interest in this important work, and the young graduates of the college taking such an interest in agricultural affairs generally. I have taken great pains to compare what I have seen at this institution with what I have known about other experimental farms in other parts of Canada, and I hope to see even more of your work at this place to-morrow.

The proceedings of the evening were enlivened by songs from J. F. Beam, Black Creek, Ont., the College orchestra and the College quartette club.

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TWENTY-SIXTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO

1895.

PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY

TORONTO:
WARWICK BROS. & RUTTER, PRINTERS, &c., 68 AND 70 FRONT STREET WEST.
1896.

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PROF. C. V. RILEY, M.A., Ph. D.

WILLIAM H. EDWARDS,

Honorary Member of the Entomological Society of Ontario, etc.

TWENTY-SIXTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

1895.

To the Honorable the Minister of Agriculture :

Sir,—In accordance with the provisions of our Act of Incorporation, I beg to submit herewith the Twenty-Sixth Annual Report of the Entomological Society of Ontario.

The report contains an account of the proceedings at our annual meeting, which was held in the city of London on the 27th and 28th of November last, for the election of officers and the transaction of the general business of the Society. A full report is given of the addresses delivered and papers read during the sessions, as well as the financial statement of the Treasurer and the reports of the sections and other departments of the Society.

The Canadian Entomologist, the monthly magazine issued by the Society, has been regularly published and has now completed its twenty-seventh volume, which in value and interest fully maintains the high reputation which it has so long held.

I have the honor to be, Sir,
Your obedient servant,

W. E. SAUNDERS,
Secretary.

OFFICERS FOR 1896.

President.....J. W. Dearness .....London.

Vice-President.....H. H. Lyman .....Montreal.

Secretary.....W. E. Saunders..... do

Treasurer .....J. A. Balkwill ..... do

Directors :

Division No. 1.....James Fletcher .....Ottawa.
" 2 .....Rev. C. J. S. Bethune.....Port Hope.
" 3 ... .Gamble Geddes .....Toronto.
" 4 .....A. H. Kilman .....Ridgeway.
" 5 .....R. W. Rennie.....London.

Librarian and Curator .....J. A. Moffat ..... do

Auditors ..... { J. H. Bowman..... do
J. M. Denton..... do

Editor of the "Canadian Entomologist"..... ... } Rev. C. J. S. Bethune.....Port Hope.

Editing Committee..... { J. Fletcher.....Ottawa.
H. H. Lyman .....Montreal.
Rev. T. W. Fyles .....S. Quebec.
J. M. Denton .....London.

Delegate to the Royal Society ...J. D. Evans.....Trenton.

Committee on Field Days.... { Dr. Woolverton, Messrs. Sherwood, McClement, Balkwill, Saunders, Anderson, Rennie, Bowman, Elliott, and Stevenson.....London.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY

1895

The thirty-third annual meeting of the Entomological Society of Ontario was held in its rooms in Victoria Hall, London, on Wednesday and Thursday, November 27th and 28th, 1895. In the absence of the President, the chair was taken by the Vice-President, Mr. J. W. Dearness, of London.

The meeting was called to order at four o'clock p.m., on Wednesday, the following members being present: Rev. C. J. S. Bethune, Port Hope; Mr. J. D. Evans, Trenton; Mr. James Fletcher, Ottawa; Mr. H. H. Lyman, Montreal; Rev. T. W. Fyles, South Quebec; Messrs. J. A. Balkwill, J. M. Denton, E. R. Cameron, J. A. Moffat, W. E. Saunders, R. W. Rennie, W. T. McClement and others, of London. A letter of apology was read from Mr. W. H. Harrington, of Ottawa, President of the Society, and a telegram from Capt. Gamble Geddes, of Toronto, regretting their inability to attend the meeting.

Mr. J. A. Moffat, the Librarian and Curator, presented and read his annual report, as follows:

REPORT OF THE LIBRARIAN AND CURATOR

FOR THE YEAR ENDING 31ST OF AUGUST, 1895.

The number of volumes added to the library by gift and purchase during the year was twenty-two. Ten volumes were sent to the binder, but some delay occurred in their return, which prevented their being entered within the year. I considered it desirable to include them in this statement, and in doing so, I had to include several others previously entered, which bring the number added to date up to thirty-eight.

The whole number on the register is 1,399.

The number of volumes issued to local members was thirty-three.

Mr. Fletcher has generously contributed to the library six volumes of the proceedings of the American Association for the Advancement of Science.

Many interesting additions have been made to the Society's collection of native lepidoptera during the year; principally by Mr. C. G. Anderson, one of our local members.

The specimens of *Nemeophila petrosa* received from Mr. Bean of Laggan, have been given a drawer to themselves, arranged in order as upon the plate, with the original numbers attached. The portions of Mr. Bean's paper descriptive of the individual specimens have been placed with them.

Mr. Rennie obtained by exchange cocoons of *Platysamia ceonothi*, and *Antheræa mylitta*, "the India Tussah silk moth," which he kindly shared with the Society. These matured and gave forth their imagoes, which have been placed with the exotic collection.

Respectfully submitted,

J. ALSTON MOFFAT,
Librarian and Curator.

The Treasurer, Mr. J. A. Balkwill, presented the annual statement of the finances of the Society, as follows:

REPORT OF THE TREASURER.

RECEIPTS.

Balance on hand Sept. 1st, 1894	$ 360 60
Members' fees	309 39
Sales of Entomologist	88 56
" pins, cork, etc	66 61
Government grant	1,000 00
Advertisements	21 40
Interest	9 47
	$1,856 03

EXPENDITURE.

Printing	$ 644 33
Report and meeting expenses	216 00
Library	47 38
Expense, postage, etc	117 02
Rent and fuel	102 70
Insurance	28 00
Salaries	300 00
Pins, cork, etc	58 69
Balance on hand, August 31st, 1895	341 91
	$1,856 03

We hereby certify that we have examined the books of the Treasurer and compared them with the vouchers, and find them correct and that the above is a correct statement.

JOHN M. DENTON,
JAS. H. BOWMAN, } Auditors.

The Treasurer explained the various items of receipts and expenditure and stated that it would require the closest economy to carry on the work of the Society during the remainder of the year. Dr. Bethune and Mr. Fletcher spoke in commendation of the valuable services of Mr. Balkwill and of the high appreciation in which they were held by the members of the Society.

Mr. W. E. Saunders gave an account of the proceedings of the local members of the council with regard to obtaining more suitable and commodious rooms for the Society. After a long discussion, which was participated in by most of the members present, it was resolved that the matter be left in the hands of the local members of the council, who were authorized to take whatever action seemed to them most desirable for the welfare of the Society.

An application from the Senate of the Western University of Ontario was read requesting that their students in geology should be permitted to attend, free of charge, the meetings of the geological section of the Society. After some consideration it was resolved that the matter should be left in the hands of Dr. Woolverton, who is to deliver the lectures, and that he should have the liberty, which is shared by all the members, of introducing friends to the meetings of the section.

The following report of the council was next read and adopted:

REPORT OF THE COUNCIL.

The council of the Entomological Society of Ontario have much pleasure in presenting the following report of their proceedings during the past year:

They have much satisfaction in stating that the membership of the Society in London, and in the Province of Ontario generally, has largely increased, and that additions have also been made to our numbers in other parts of the Dominion, especially in British Columbia. The list of subscribers in the United States and Europe has continued about the same. The total number of names on our books is now considerably larger than ever before since the formation of the Society, while the interest in its work has by no means diminished.

The twenty-fifth annual report on Economic and general Entomology was presented to the Minister of Agriculture for Ontario in November last, and was printed and distributed at the beginning of January. It contained one hundred and twenty-six pages, a larger number than hitherto, and was illustrated with no less than sixty wood cuts, and two full page portraits, one of Prof. William Saunders, one of the founders and for many years President of the Society and editor of *The Canadian Entomologist*, and the other of Mr. A. R. Grote, of Hildesheim, Germany, one of our honorary members and a constant contributor to our publications. In addition to an account of the proceedings at the annual meeting, the volume contains the annual address of Mr. Harrington, the President, and the following interesting and important papers: "Insects collected in Bermuda," by Capt. Geddes; "Common names for Butterflies—Shall we have them?" by Mr. Lyman; "The Butterflies of the Eastern Provinces of Canada," by Dr. Bethune; "The Pitcher-plant Moth," The Gypsy Moth," "The San Jose Scale," and "Injurious Insects of the year 1894," by Mr. Fletcher; "Foods, Feeders and Fed," by Mr. Fyles; "The economic value of Parasitism," by Mr. F. M. Webster; "The structure of the undeveloped wings of the Saturniadæ" and "A reappearance of Pieris protodice," by Mr. Moffat; also a report of the sixth annual meeting of the Association of Economic Entomologists together with a few of the most interesting papers.

The Canadian Entomologist, the monthly magazine published by the Society, completed its twenty-sixth volume in December last. The numbers of the twenty-seventh volume have been regularly issued at the beginning of each month during the current year; the closing number for December is now in type and will be distributed next week. The volume when completed will consist of about 360 pages, and is illustrated by no less than six full page plates and twenty-three wood cuts Among the contributors to its pages are most of the leading Entomologists in North America as well as several in Europe. It is now the oldest monthly publication on insects published in America, and continues to maintain the high reputation that it has so long enjoyed.

A noteworthy event in the history of the Society is the republication, through the kindness of the Minister of Agriculture for Ontario, of the first annual report of our Society, which was prepared by Messrs. Bethune, Saunders and Reed in the year 1870, and published early in 1871. It contains articles on the insects injurious to the apple, grape and plum, and has been for some time out of print. Nothwithstanding that almost a quarter of a century has gone by since it was first issued, the volume is still in demand for public libraries and private collections.

The cabinets of the Society have been carefully looked after by the Curator, Mr. J. Alston Moffat, during the past year, and many valuable additions have been made. The collections owe many of these additions to the zealous work of Mr. C. G. Anderson, who has devoted much time and energy to the lepidoptera in the neighborhood of London. Mr. Bean, of Laggan, has presented a set of the specimens of *Nemeophila petrosa* which were illustrated in the April number of *The Canadian Entomologist*. Mr. Rennie has presented specimens of some interesting silk moths, of which he had obtained the cocoons; and Mr. Rowland Hill a beautiful case of Australian insects.

Mr. E. Firmstone Heath, of Cartwright, Manitoba, has sent through Mr. Fletcher, some interesting and rare lepidoptera captured in his own neighborhood; and Mr. Green, of Osoyoos, British Columbia, has also sent some very valuable and typical representative specimens of butterflies from the Okanagan valley.

The library is steadily growing and now numbers 1,400 volumes, many of them being rare and extremely valuable works.

The report of the Treasurer shows that our finances are in a satisfactory condition. The balance on hand at the close of the financial year is about the same as in his statement at our last annual meeting, and will all be absorbed by the expenses attending the remaining portion of the year. The question of rooms for the Society will have to be dealt with very soon, as the present quarters are too small for the library and collections and the meetings of the sections. It is to be hoped that the new council will be able to settle the matter to the general satisfaction.

The reports of the geological, microscopical and botanical sections are presented herewith. They have held regular meetings during the past season and have accomplished much satisfactory work. The ornithological section has become so much reduced in numbers that no meetings have been held, but it is confidently expected that there will be a revival of interest next year.

The Society was represented by the Rev. T. W. Fyles at the annual meeting of the Royal Society of Canada held in Ottawa in May last. His report is also presented herewith.

All of which is respectfully submitted,

W. E. Saunders,
Secretary.

Mr. Lyman read the report of the Montreal branch as follows:

REPORT OF THE MONTREAL BRANCH.

Annual meeting of the Montreal branch of the Entomological Society of Ontario.

The twenty-second annual meeting of the Montreal branch was held in the library of the Natural History Society, on Tuesday evening, 14th May, at 8.15 o'clock.

Members present: Messrs. H. H. Lyman, President; Lachlan Gibb, Vice-President; Geo. Kearley, and A. F. Winn, Acting Secretary.

The President presented the following report of the Council:

Report of Council.

In presenting their twenty-second annual report the council have much pleasure in congratulating the branch upon having unquestionably come of age,* and feel that so long a period of continued and unbroken existence is worthy of remark in view of the very small numbers interested in this pursuit.

During the year seven meetings were held and the following papers and communications were read:

An hour at Hochelaga, A. F. Winn.

Notes on the season of 1894, H. H. Lyman.

Note on the occurrence of Pamphila Manitoba at St. Hubert P. Q, A. F. Winn.

Mantis and Mantispa, H. H. Lymann.

How the forest of the district of Bedford was swept away, Rev. T. W. Fyles.

Note on the occurrence of of *Chionobas Tarpeia* in North America, H. H. Lyman.

Four new members have been added to the branch's roll and it is to be hoped that increased energy will be shown in the study of the many inviting subjects which this department of science holds out to those students who are really in earnest in the pursuit of knowledge.

The Treasurer's report shows that the finances of the branch are in a healthy condition.

Respectfully submitted on behalf of the council.

H. H. Lyman,
President.

*It was organized 16th October, 1873.

It was moved and carried that the reports of the council and Secretary-Treasurer be received and adopted.

The following officers were elected for the ensuing year:

President—H. H. Lyman.

Vice-President—A. F. Winn.

Secretary-Treasurer—Lachlan Gibb.

Council—G. Kearley, W. C. Adams.

The meeting then adjourned.

Lachlan Gibb,
Secretary.

Regret was expressed that no member had been able to represent the Society at the annnal meeting of the Association of Economic Entomologists held at Springfield, Mass., in August last. Through the kindness of Mr. L. O. Howard a full account of the proceedings has been received, and an abstract will be found in subsequent pages of this report.

Mr. Lyman exhibited a handsome quarto volume containing beautifully colored plates of the butterflies of Germany, which only cost, when delivered here, $4.59. It is entitled "Die Schmetterlinge Mittel-Europas," by Mar Korb, and is published at Nuremburg, Germany.

A paper was next read by Mr. Lyman on *Colias Interior*, the consideration of which was deferred to the following day.

The hour of 6 o'clock having arrived the meeting adjourned.

EVENING SESSION.

In the evening the Society held a public meeting in the City Hall,which was attended by between fifty and sixty persons, for the most part members of the Society. The chair was taken at 8 o'clock by his Worship, Mayor Little; on the platform were Professor C. C. James, Deputy Minister of Agriculture for Ontario, Rev. Dr. Bethune, Rev. T. W. Fyles, Mr. Dearness, Mr. W. E. Saunders and Dr. Roome, M.P. The Mayor opened the proceedings with the following remarks :

Ladies and Gentlemen,—Our city has had the good fortune in recent years to be many times selected as the meeting place of conventions of fraternal and other societies and we are always glad to welcome them in our midst. To-night we have amongst us the representatives of a society, which, though provincial or Dominion in its character, has its headquarters in our own city and is therefore all the more welcome on that account. I am sure, although there are not a very large number present to-night, you will make up by your enthusiasm for whatever you may want in numbers. This Society has been quietly doing a very valuable work in our country. I understand that the journal which they publish is considered the most valuable work on entomology that is published on the continent of America and it is also the oldest. It is all the more interesting to us,because the Society was founded largely through the efforts of Mr. Bethune, who is on the platform to-night, and one of our own fellow citizens, Prof. Saunders, whom though at Ottawa, we still look upon as a citizen and we are proud of him and his work.. I therefore say this Society has a warm place in our hearts, because of its origin, and because it has remained among us. I am sure those who have come out to-night will not regret it.

Without any further remark I will call upon Prof. James of the Department of Agriculture, Toronto, to address the meeting. (Applause)

THE NEW AGRICULTURE.

By Mr. C. C. James, Deputy Minister of Agriculture.

Mr. Chairman, Ladies and Gentlemen, and members of the Entomological Society, I believe it is somewhat of an innovation for the Ontario Entomological Society to hold an open meeting, or as we sometimes say a popular meeting, in connection with its deliberations. This, I take it, will have the effect of bringing the Society more into sympathy with the people, or rather of bringing the people more into sympathy with the workings of the Society. As a rule we find that the best men do their work most quietly. The men in this world who do the most advertising of themselves, who create the greatest stir for the time being, are not always the most important men in the world. So with regard to many of these societies, those who are doing their work the most quietly are very frequently the ones that are doing the most important work for the community. And the very fact that this Society for twenty-five years has been carrying on its work by

itself, quietly, without creating very much stir, is not a condemnation of the Society, but, to my mind, the very fact that it is able to live after years of this quiet life shows it has that true vitality which will enable it to exist and to do good work in this world. (Applause)

We are not very many who are gathered here to-night, and what we have to say will be more in the line of a quiet talk between ourselves, more or less of a conversation one with another, with regard to the work in which we are interested. I propose to talk in regard to general agriculture and in connection with my remarks I may have something to say in regard to entomology and its relationship to agriculture. I do not consider that there is any more important question to be discussed or studied by city people, as most of you no doubt are, than this subject of agriculture. Some one may say that agriculture ought to be reserved for farmers and farmers' sons and families, and that the bringing in of the subject of agriculture at a town or city meeting is a great mistake. But there are two or three reasons that we can offer in connection with this, that are quite sufficient to warrant us in introducing a subject of this kind. In the first place we all admit that this country is first and foremost an agricultural country, that the progress of this country depends more upon agriculture than upon any other industry and that just as agriculture rises or falls so will the general prosperity of this country rise or fall with it. When the farmer is prosperous, has good crops and good prices, the people in the towns and cities feel the effect; and depression in the country is felt very soon in the city. Then again there is an old idea, now being rapidly removed, that agriculture after all is not a very interesting subject. The principal reason of talking to-night is to endeavor to show to you, in an indirect manner it may be, that after all there is a great deal of interest in agriculture for the people of our towns and cities.

There has been more or less talk of teaching agriculture in the schools and some have said it should be taught in the rural schools, but there are many people in this country who have looked into this question and who after thinking over it carefully have come to the conclusion, that agriculture should be taught in our city schools as well as in the country; that there is as much need for the education of our city pupils as for the rural in the subject of agriculture. Perhaps I may be able to show you, in a few cases at least, that agriculture is not that dry hum-drum business that many of us have sometimes thought it to be, but that connected with it are some of the most important and interesting questions that have presented themselves to the mass of human beings. We have heard a great deal of late in regard to many of the new questions, the *new woman* for instance has filled column after column of our city papers. Now it struck me in looking around for a subject that possibly I could not take anything better than this "*the new agriculture.*" (Applause.)

What are the changes that have taken place, or what are the forces that are present that have given us and are giving a new agriculture?

The first is the great increase of transportation facilities. Those of you who are older than the speaker here to-night will remember the time when transportation between the old countries of the world and this country was very slow. To-day we have the great continents connected by lines of steamers that run as rapidly as some of the accommodation trains upon our railroads. Nearly every continent in the world is belted by one or more great trans-continental railways. Even Russia is about completing a great trans-Siberian railway, Africa will be the next country to have a trans-continental railway. The result is that the world, so to speak, has been shrunken up and although we have these continents at distances of five to eight thousand miles apart and although we have great stretches of country such as this North America of ours, still with the improved steamship lines and railways, these countries have been so closely brought together that practically this world is now simply one great continent or one great country. What has been the effect of that? The effect has been that the great consuming markets have been brought closer to their sources of supply and it is not very much of an advantage now to be stationed a thousand, or two, or three, or four thousand miles nearer to the great consuming centres of the world, than some other countries. For instance Canada, because she is only some four thousand miles from England has not a very great advantage over Australia which

is, I think, some twelve thousand miles away. South America is practically as close to Europe to-day as we are. Africa, both in the north and south is about as close to Europe as we are. There is very little difference in the cost of transportation over these great ocean distances and the result of it has been, that these countries with great territories of fertile lands, and with cheap labor, have been able to produce with almost equal facilities the enormous quantities of crude materials, such as wheat and oats and barley, and as a consequence the great consuming countries of the world are supplied as they have never been before. And the prices of these products have been going down lower and lower until we find that one great result has been that these crude products of the farm have been brought to the great commercial centres at very low rates Let me give you a couple of instances. It costs about thirty-four cents to pay all charges for sending a bushel of wheat from Manitoba to Liverpool, let us say half a cent on a pound. From Australia butter has been shipped to London at a rate less than two cents a pound. The transportation charges have been brought so low that it is possible to ship butter in refrigerator steamships from the dock in Australia to the dock at London for a smaller amount than it can be sent by rail from the north of England to the south. So that you see the great increase in transportation facilities has reduced distances; has brought the great producing nations of the world closer to one another, and they can now barter in the markets at about equal advantage one with the other. The result of this has been that the products that are of easy production have suffered in price as a consequence, and only those products which are more difficult to produce, which are produced by the more highly cultivated people, by a people with better facilities, with better training and better education, have been able to hold their own. Our farmers to-day are turning their attention more and more to the production of these higher classed articles, these articles which require more skill, because thereby they come less and less into competition with cheap labor and cheap soil. The production of these lower grades brings their higher priced labor in competition with lower priced, whereas the production of the higher classes, such as the best class of fruit and dairying production brings them into competition, not with cheap labor and cheap lands, but with the better class of labor and lands of Europe.

The second cause is the application of machinery. This perhaps might not at first sight present itself quite as forcibly to your minds as it will if I give an instance or two. The grains as we grow them, such as wheat and barley, have been raised from time immemorial. It is impossible to say when wheat and barley and grains of all kinds were first produced upon the earth. Go back as far as you will, you will find in history and in archæological remains the traces of the instruments for cutting have been shaped something like the curved arm, the sickle, and yet if you think, it was only the other day the sickle went out of use among civilized people. From the time that wheat and barley and oats were first produced until within a few years ago, the sickle, with practically little or no change, remained the sole reaping instrument of the human race. About 1826 a Scotch minister presented for examination to the Highland and Agricultural Society of Scotland a new machine, the forerunner of what we now know as the reaping machine. About the year 1831 Cyrus MacCormack brought out the first reaping machine in the United States. It was not until the year '41 or '42 after ten long years of experiment and changing and testing that this machine was finally put upon the market. It is only within the last fifty years that the sickle, the scythe and the cradle after being used for so many centuries have been superseded by the reaping machine. All at once what wonderful developments began. The reaper and the mower, and then a very few years ago came the self-binder, and we have to-day in California the harvester and header machine, drawn by from eighteen to twenty-four horses or mules, which reaps and threshes the grain and leaves it in bags on the field. The question we ask ourselves right here is, "What next?" One hesitates to say or give an answer to that question when we see what has happened, what wonderful steps in progress have been made from the simple sickle or scythe to the self-binder. When within the period of thirty or forty years such wonderful evolution has taken place after a long period of quiescence, one may say, what will be introduced next?

Take another instance. In connection with dairying the method in olden times of churning the milk was by a very simple operation, either by means of a bag hung up and

pounded or swung around, or else in a vessel quite similar to our old-fashioned barrel churn. It is not very many years since the old-fashioned dash churn and implements of this kind were used for the manufacture both of butter and cheese. Then someone introduced the application of power, such as horse power, steam power, the introduction of the box churn and one after another applications of the various kinds of machinery began to be made, till now what have we to-day? We have a machine that can be set up in the barn to milk the cows. Although this machine is in an undeveloped condition, nevertheless it does its work and proves we are on the right track. That milk drawn by a machine can now be put into another machine and by means of it the skim-milk comes out of one spout and the cream out of another. This cream can be put into another vessel or machine, and by proper temperature and the addition of a substance somewhat resembling yeast, a fermentation can be started, and just that kind of fermentation that we desire in connection with it. After the fermentation has gone on a certain time this can be put into another machine and churned, and after churning it can be worked and packed by machinery. So that now it is possible, although not altogether practical, from the very milking to the putting of the finished article on the market, to do the whole of the work by machinery. This wonderful progress has taken place within the last quarter of a century.

As we look at farming in its different aspects, machinery has been applied at this point and that point, and agriculture is being put on an equality with the manufacturing establishments of our towns and cities. You ask yourselves this question, "Why have our great manufactures in the towns and cities developed?" The principal reason for this is in the application of machinery to the work. Why is it that machinery has been developed in connection with all these other industries and yet it has taken so long to bring the attention of inventors to the work of agriculture? Well, one reason is that there has been no great necessity for it until recent years. We sometimes hear it said that the men are leaving the farms because they are not required, because so much machinery has been brought in that a man with a machine can now do as much work as a man and two hired men could do before. There is another side to that question, viz., because of this drawing away of so many farmers' sons from the farms to the towns and cities, because of the want, therefore the supply of machinery has been produced. Both of these things no doubt have been effective. That is, machinery has been produced because it has been required; and people have left the country since they were not required because of the presence of machinery. According to the census of 1891 there were farmers and farmers' sons in Canada to the number of 649,506, in 1881 there 656,712. From '81 to '91 the number of farmers and farmers' sons in Canada decreased by over 7,000, yet during that period we had the opening up of Manitoba and also of the North-West, and the agricultural product of Canada is greater to-day than it ever was before. If you put these two or three facts together you can easily see the great part machinery has been playing in connection with agriculture in Canada for the last ten years. Although the number of farmers decreased to the extent of 7,000, nevertheless the total output of agriculture has vastly increased. This is owing to a great extent to the application of improved machinery in connection with agriculture.

The next point in connection with agriculture that I wish to refer to is one that comes as a sort of rider to the last; a companion to it, namely, the application of science to agriculture. Now, in certain quarters the moment you begin to talk about the science of agriculture and scientific farming an objection is raised and people say there is nothing scientific about it, it is all practice, and when you find a scientific farmer you find a farmer who does not make much progress.

I desire to give a few facts to show that science has been applied quite successfully to the improvement of agriculture in this country, and further, that just as we bring to bear upon agriculture the latest and best developments of the different sciences, so we may expect agriculture to make improvement. One of the great reasons why agriculture remained on a dead level for so many centuries was simply because the attention of scientific men had not been directed to agriculture as a field for investigation. Scientists had been expending their time and energy with the work that is carried on in

towns and cities. To-day we find as much attention being paid to the science of the calling of agriculture as to anything else, and the result has been wonderful progress, a wonderful development, which has begun of late and which is now in progress, and the result of which we can hardly forecast at the present time.

Let us take two or three illustrations: We sometimes hear it said that there is not very much in agriculture, that it is a dry subject, with nothing interesting in it, that it belongs so to speak to the common people and not to the literary class; there is nothing about it likely to attract the attention of people. Now, I will give you an illustration, which probably you may have had presented to you before. It has been known for years that there is wonderful difference in different crops, in the methods of their feeding. For instance, they say clover will feed in one way, that wheat will feed in another, that our common grasses of the field feed in another, and because of their different methods of feeding, therefore, it is advisable that we rotate crops, one kind one year, another kind another year. We can perhaps illustrate that by representing before us here a large table. Suppose a long table were set up in this room, filled with all manner of food, and you as an audience were asked to sit down at the table to partake or taste, and to take all you would want to eat. No two of you would want to eat the same kind of food. One man would have a preference for fruits; another man might have a great preference for meats; in fact there would be a choice in the kinds of meat. Your tastes differ; your methods of feeding differ. After you were through, if you will allow the comparison to be taken to a little lower level, suppose we were to bring in some animals of another kind whose tastes were different from ours, they would be able to take from what was left. Still there would be a portion of the food they would not take, and we could bring in something else and finally the scraps might be thrown out to the poultry. So if you alone were to be fed upon that food there would be a considerable amount that would not be taken; you could not make use of it, but what you did not want some other animal would devour; what the second class of animal would not devour the third would. Here is a large feast, so to speak, prepared by nature for plants, and we put one kind of plant upon that soil this year. It has a preference for a certain class of food and takes it, and next year another kind of plant is put upon that field which has a different feeding capacity from the one of the preceding year and that plant takes what the other one does not want, and so on by rotating year after year, for three or four or five years, we are able to satisfy the wants of all, whereas if we kept on with the one plant year after year, we would have exhausted the particular food of that one plant and the rest of the food that was there would have been left lying idle all the time. Many farmers in years past, thinking the soils of this country were entirely inexhaustible, put in wheat this year and wheat next year and so on, until finally they were forced to the conclusion that there was nothing left for the wheat and they have taken their attention to other things. We find in many cases what was once a first-class wheat farm became a very poor wheat farm, and then after a number of years that poor wheat farm has become a first-class dairy farm, because different crops have been grown for milk, butter, and cheese.

I want to refer more particularly to one of these plants, viz.: Clover. I do not think there is any plant that presents a more interesting study, interesting though they all may be, than this much neglected and underrated clover plant. It was found that it fed in a different way entirely from the wheat, and then the question that presents itself to the minds of some of these much despised scientists is, in what way does that clover plant live? How does it differ in its feeding from other plants? After a long and careful examination, some came to the conclusion that it got most of its nourishments out of the air. Others concluded because it had a long root and it could go down into the sub-soil, that it got its nourishment there. They finally found something that had escaped the attention of most examiners, in connection with the roots of the clover plant upon which there were little knots or nodules. Now, I suppose hundreds of thousands of clover plants had been examined and these little knots had been seen. Someone who was a little more inquisitive pushed his question a little further and began to ask himself this question seriously: "Now this little bud or nodule on the roots must after all play some part in the economy of this clover plant." And to sum the whole thing this has been the

result of investigation; that these little knots are filled with very minute organisms very difficult to describe, very minute specks somewhat similiar to the very minute specks we find in yeast These are living in the roots like little parasites and the effect of their living there is to take up nitrogen from the air and in some way to give it to the plant for its subsistence, so that whenever one of these nodules comes on the clover root we find it has the means of taking up food out of the air, and then when we turn over the plant and allow it to decay in the soil, we put in the soil a certain amount of food that this plant has taken up out of the air; and the result of it is there is an excess of food there for the next plant that comes along. Now the wheat does not possess that little nodule and it does not take up the nitrogen out of the air, and the result has been that, that little investigation,—little we may call it, yet momentous in its results—has established the practice of preceding the wheat crop by a crop such as clover, or peas or beans.

Let me give you one instance in connection with entomology which has seemed to me since I read it some years ago, almost like a fairy tale. I will give it to you just as it stands. About eight or nine years ago the complete destruction of the orange groves of California was threatened by the spread of an insect known as the cottony-cushion scale. This insect was covering the limbs of the trees and the result was the vitality was being sucked right out of these trees by millions of tiny insects. The pest got completely beyond the control of the fruit growers of that country and in their despair they appealed for help to somebody or anybody. Professor Riley who was in charge of the Entomological Department at Washington, and who unfortunately met his death this year,—one of the greatest benefactors the American people has ever known —at once began the investigation of that question. Being an expert entomologist he knew practically every country in the world where that scale insect was common and he knew that the most likely place from which it had come was Australia. It had probably been introduced some twenty years before that, in bringing in fruit trees or vines from Australia. He however knew it had never become a pest in Australia. Now if it is found in Australia and later found in California and has become a pest in California and has not become a pest in Australia, he concluded that there must be something in Australia that will stop it, so he despatched two assistants to Australia to investigate it and they sent back consignments of lady-bug beetles or lady-bugs as they are commonly known. You have seen these running back and forth over the leaves and branches of the fruit trees doing great destruction to the other insects. Within a very short time, less than a year, although these scale insects had been increasing for twenty years and practically had the products of California by the throat, and in fact had taken possession of the country; in less than a year, this little lady-bug increased to such quantities that it swept the scale out of existence or got it into such control, that the fruit interests of California were saved. (Applause). I do not suppose that anybody could sit down and figure up the amount of money that was saved or made for the United States by that simple little insect brought in by a man known to very few present. You do not see his name prominent in the newspapers. The fact was not heralded broadcast in great flaming type. He was not given any great ovation. It is a question whether any monument will be erected to him by the United States, yet it is doubtful whether the United States has had any greater benefactor than that man and his associates.

Take the potato bug, what would we do to-day if we did not know that simply by dusting Paris green on potato plants we could effectually head off and kill the potato beetle. We could not raise potatoes at all. Where has that come from? It was not picked up by chance, somebody did not sit down one day and write to the paper that he thought that if you dust the potato bug with Paris green you would stop it. Back of that was careful investigation by these same men who study the habits, mode, and living and all about the potato bug. We might go on and give instance after instance. A great many of the various methods that are being practised to-day, many of the best practices we have in connection with agriculture to-day have come, not by hap hazard or by chance, but have been worked out by men on small salaries, working in obscure places, who have devoted themselves to their work with such energy as we have not had surpassed in any other calling, I care not what one you mention.

What a large portion of our reading is monopolized by a few things. I suppose the people of London know how much importance is attached to politics. It seems to be necessary the world over to have politics, but there are other things that are constantly filling the newspapers. What does that prove? That the people want to hear about these things, that the people have their attention taken up with these things, yet it is not very often that you find the most valuable columns of the newspapers given over to some great agriculture event, unless it may be in the case of agricultural depression or crop failure where there is something that is going to effect the finances of the whole country.

The point I want to make is this, there are lots of things happening in connection with agriculture, that are far more important to the prosperity of the country than these things which seem to occupy such an important place in connection with public attention. I have brought along with me a picture to illustrate that. Last summer, many of our Canadian papers were interested in a discussion, as to whether the American Society of Colonial Wars should be allowed to go down to Louisburg, Cape Breton, and erect a monument to commemorate the taking of that place by the Americans, British Colonists, as they were at that time. If I remember correctly some 150 years ago they occupied the place and held it for a short time, and then the French people took it back again. Now that event has cropped up again, after a period of 150 years. That event has been made so important to a large class of the community that they felt themselves constrained to raise a large fund, to get together a large excursion party, and to journey to Louisburg and erect that monument. It created so much attention at the time that it was a matter of doubt as to whether the Canadian Government ought to allow these people to go over there and erect the monument or not. This picture was sent me by Mr. Thompson, of Massachusetts, and I will just read you the inscription upon it. It is doubtful whether half a dozen in this room have ever seen this in the newspapers, or whether they know such a monument was erected. "This pillar, erected in 1895 by the Rumford Historical Association, incorporated April 28th, 1877, marks the estate where in 1793 Samuel Thompson, Esq., while locating the line of the Middlesex Canal discovered the first Pecker Apple Tree, later named the Baldwin." Now, I will submit it to you as to whether it was of more importance to the country to capture and hold for a short time, that little point down there on Cape Breton, or to discover the "Baldwin Apple." That Baldwin apple was discovered in 1793, and at the present day if you pick up in the fall of the year, just about this time, the market reports in Liverpool, you will find a few kinds of apples mentioned. Greenings so much a barrel, Spies so much, Baldwins so much. Practically from that day to this the Baldwin apple has been produced over the Eastern and Western States, and in Canada, and has been bringing in year by year a large amount of money to the American people. And yet events of that kind are practically lost sight of; whereas events such as I have spoken of, are blazed forth to the country and the minds of the people are filled with it. Now it seems to me these things are out of all due proportion. Probably we cannot rectify them, yet the point I want to make here is that there are a great many things happening, there are a great many conclusions being arrived at in connection with the prosperity of this country that are entirely overlooked, whereas other events that are of little consequence after all, are magnified and fill column after column of the newspaper. What is the result of this? Suppose you ask the boys and girls in the rural parts, and the boys and girls in our towns and cities, what effect the reading of these matters has upon their minds? Is it not a fact that it suggests to their minds the paramount importance of politics and such things as concern town and city life. The result is their minds become filled with the events of town and city life; their inclinations are drawn off in that direction; the ties which bind them to agriculture become cut one after another, and the ties which lure them away become greater and greater, till we find a great many of these, to their discomfort afterward, are lost to agriculture and a great many men who would have made first-class agriculturalists, are drafted off in other lines of work to take second and third-rate positions.

The last point I desire to touch upon in connection with this new agriculture, is that during the last ten or twelve years, to say nothing about the past twenty-five years,

there has been wonderful development in connection with the facilities for acquiring information in regard to agriculture. These things that I have mentioned I have no doubt will be righted some day, and before long you will find the histories of this country will not be filled merely with accounts of men killing one another, they will not be filled merely with the names of persons who have occupied positions in towns and cities, but you will find there the development of the people traced. A gentleman came to me the other day who had for sale a book, dealing with the history of this country. He said: "You will find there everything in connection with this country." I said: "I will be very glad to get it, I have been looking for a great many things and have not been able to find them." Now, before you go away we will just try it. I said: "When was the first Agricultural Society formed in Ontario? "I don't know," well, I said, "that is of importance, is it not?" Is there any organization or institution that has done more to build up and develop the country, until probably within the last four or five years, than the Agricultural Society? It is of as much importance to know as when a certain kind of industry was established in some town or city. I have been on the search for it for the last five years, and finally I think I have nailed it down. There is an utter absence of all these facts in regard to the agricultural development of the country. Until we come down to the period of twenty-five or thirty years it has almost all disappeared. They can tell you of the men who have been elected to Parliament from the very first up to now. They can give you the vote that was polled in connection with any election. They can tell you, perhaps, when a certain new kind of machinery was brought into the country. They cannot tell you when the first improvement was made in connection with live stock, when the first thoroughbred live stock came into the country. I say that it is of much importance to know when these agricultural industries began and how they developed, because on these, rather than the others, the prosperity of this country has been built up. My point is, there ought to be a proper balance between these things and our histories should not be filled with other events to the exclusion of those which are equally important.

A wonderful change has taken place in the facilities for carrying on experimental work and getting an agricultural education. Take this province, we have the Agricultural College at Guelph and the Experimental Farm at Ottawa, from which our friend Mr. Fletcher comes. We have a school or college of agriculture at Kingston, and now we have a dairy school in the west at Strathroy, so we have four points in this province from which comes information in regard to some of the later developments in agriculture. Then we have six or eight different points at which experiments in connection with fruit growing will be carried on, and there is a great development along that line. Before long we will have this province dotted over with little stations from which the latest information may be obtained, and each of these will be a centre leavening the whole surrounding country.

Then we have the societies. Beginning with the time of the organization of the Province of Ontario in 1867, we have from then on had the organization of society after socie y. till now we have three dairy associations, two poultry associations, the fruit growers, the bee-keepers and the sheep-breeders and the swine-breeders, and a great many other stock associations, and last, but not least that association to which we are indebted tonight for this meeting, the Entomological Society which has now been carrying on its work most successfully for the last twenty-five years. I think these societies have all been accomplishing a great deal of good in this country. Some may say they do not get any great benefit, they do not come in immediate contact with the Entomological Society, but each one of these men so to speak becomes a source of information and as they go from these meetings to their homes, to this point and the other, they give out their information. They also come in contact with other men through their writings.

This Society has been quietly doing one of the most important works in connection with agriculture in this province. If these gentlemen were not present I might say something even a little more flattering with regard to them. I have had occasion from year to year of examining the reports of their meetings which they have sent out, because they are published in the department to which I am attached and I can simply say this,

that if the work of all the other societies was as well done as the work of this Society our labors at Toronto would be very much relieved. When the report comes in it is ready at once to go to the printer and we have no further work in connection with it, and year after year when I read that report I have been astonished with the amount of work that has been condensed and packed away. It is not a padded report, it is a report full of information. In looking over the list of persons to whom it is sent I find it has gone to almost every corner of the world. These men have not been content to hide their light under a bushel, but their work has gone out into every province, and has gone out into the whole world. Someone may say, "I do not see any good in finding out what is the peculiarity of certain insects or finding out just how they live." I do not see any good result coming from the work of the bacteriologist who studies with the microscope things small, so that if you were to take up a drop of milk on the point of your penknife and were able to count its inhabitants you would find 1,000,000,000 of these living plants in that drop of milk. The whole system of dairying has been revolutionized by the work of that man who is sometimes called unpractical.

Whenever I hear any of these objections I sometimes think of a saying of Franklin. Franklin you remember in connection with his experiments in electricity sent a kite into the clouds. He told the people that there was electricity up there and they laughed at him. He sent up his kite but the electricity did not come down. However, fortunate for the occasion, we are told, that the kite went up into a black, dark cloud which he positively felt was filled with electricity. Shortly afterwards the rain began to fall. It came down wetting the kite and trickling down the string. Then the hand that held the wet string began to feel the throbbing of the electricity; he proved it to them and they said. "What is the use of it?" And he said. "What is the use of a baby? It will grow to be a man." So in regard to many of these inventions or discoveries or conclusions that the entomologists, and chemists and botanists, and bacteriologists, and biologists and other scientists may find with regard to agriculture. Their discoveries are in the condition of Franklin's baby, and if we will only wait and have faith in the work we are engaged in and give true encouragement and sympathy, some of us at least may live to see these scientific babies grow up to be good, strong, stalwart men in connection with the practice of agriculture in which we are so much interested. (Applause).

At the conclusion of Prof. James's address, which was listened to with great attention and heartily applauded, Dr. Bethune rose and said:

Mr. Mayor, Ladies and Gentlemen,—I propose that we offer our very hearty thanks to Prof. James, for the able and interesting address which he has just given us. Prof. James has come, I am sure, at a grest deal of inconvenience to himself on purpose to be present with us here to-night, and to encourage us by the remarks which he has made, and also to give us a great deal of very valuable information. While thanking him for his address to-night I should also like to take the opportunity,as one of the original members of this Society, to express the gratitude that our Society must necessarily feel towards the Department of Agriculture for Ontario, of which Prof. James is Deputy Minister. He has remarked this evening that our Society has been in existence for twenty-five years and the Mayor has also mentioned to-night, that our magazine, *The Canadian Entomologist*, is now the oldest magazine touching on the subject, upon the whole continent of America. But I wish to let you know one reason why our Society and our magazine have survived so many others that have have started in the United States and Canada and that is, that we have been so greatly helped throughout nearly the whole of our existence, by the Department of Agriculture for Ontario. (Applause.) We began in a very small and humble way with a little magazine of eight pages that was to be published whenever we had enough material and enough money, and we had fourteen members, all told, when we began. And we managed like many other societies to struggle on, but unlike most societies of this kind, we have not died a natural death in a few years. The Department of Agriculture came to our assistance, and gave us a small grant at first, which was subsequently greatly increased, so that while a number of years

passed, we have been able to hold our own in the domain of science in North America and to spread our publication, not only all over the continent but, we may safely say, to the ends of the earth. We have correspondents and subscribers in every part of the world, including even South America, Australia, India and Japan, as well as the different countries of Europe. I trust you will unite with me in expressing our thanks to Prof. James. (Applause.)

THE VALUE OF ENTOMOLOGY.

Mr. James Fletcher, Entomologist of the Experimental Farm at Ottawa, spoke as follows:

Mr. Chairman, Ladies and Gentlemen,—It is my pleasure and honor on this occasion to represent as well as I can a far better man than myself, namely, the President of our Society. After all the kind words which have fallen from the lips of our esteemed lecturer of the evening, the Deputy Minister of Agriculture, it is difficult to give a resume of the work and objects of the Entomological Society of Ontario without repeating something which may already have been better said. Our Society stands in the position of a Division of Entomology to the Department of Agriculture and Arts, and it is the wish of every member of the council that our work should be of the greatest possible utility to the country at large. The work done in the past has been of an excellent nature, the prosperity and utility of the Society having year by year increased, and I am happy to be able to say that, at the present time, the Society is in a more prosperous condition than it has ever been before. We have a body of active, enthusiastic workers and every equipment for good work—valuable collections of insects, as well as a first-rate botanical collection, a magnificent library, and, in addition, active branches working up not only entomology, but also many other kindred branches of science. The condition of our library is rather remarkable. It is undoubtedly the best library of works on natural history in Canada and one of the best in North America. Now I am quite certain, Mr. Mayor, that the citizens of London are not aware of this fact; they do not know of the valuable collection of books on natural history and the grand museum of insects and plants which are deposited here in their midst, but which specialists are glad to come from all parts of Canada to examine. Some people may say, "What is the use of these collections of insects and plants? They are pretty, it is true, but what is the use of them?" In reply, I would remind such enquirers that these objects are but means to an end. The main object of our Society is to prevent loss to the farmers of Ontario from the attacks of insect pests. The enormous losses which take place in the crops of the province every year from the depredations of injurious insects, can only be controlled by specialists first studying up and understanding the habits of the insects which cause the damage; for this purpose collections of various orders of insects for study and comparison are essentially necessary. Moreover, by collecting and studying all the members of a family, we may frequently anticipate and prevent injury by one species from knowing the habits of an allied member of the same family. We aim then to make our collections as complete as possible and look forward to the time when some day we may have in our cabinets representatives of all the injurious insects which have given trouble in Canada. These are matters of interest to the citizens of London, which place has always been the headquarters of our Society; and my advice to those of you who have not yet found out what treasures you have among you, is to go and find out as soon as possible; it is worth your while, and I can promise you that you will at all times meet with a courteous reception from our Curator, Mr. J. Alston Moffat, who will gladly show the many beautiful objects in his charge to anyone who is interested enough to call upon him.

Some striking instances of the usefulness of the study of entomology have already been well laid before you by Prof. James, and there are numerous others which might be cited. If any proof of the matter were needed, we have merely to think of the large number of official economic entomologists employed by the leading nations of the world,

and to notice how the study of injurious insects is fostered by the most practical people on the globe to-day, the Americans, who indeed were the first to organize a systematic study of practical entomology and fungology. These two branches of knowledge are certainly worthy of much study, for they are the two chief causes of a reduced output, in other words, loss of revenue, in every country of the world.

The losses in the agricultural produce of a country every year due to the ravages of insects are said to be ten per cent. of the whole amount, and there is a further loss of ten per cent. caused by fungi parasitic on plants grown by man as food for himself or his stock. Familiar examples of such parasitic fungi are the black spot of the apple, smut of wheat, oats, barley, etc., grape mildew and potato rot. All of these are diseases which in the past have been the direct cause of the loss of large sums of money, but which now, owing to the studies of specialists, can all be to a large measure controlled by practical methods, cheap, simple and effective, which can be used by every farmer in the country possessed of ordinary intelligence. The same thing is the case with injurious insects. Of those kinds which every year attack our crops and reduce our revenues, by far the larger proportion have been studied out so fully, by men such as those who form the membership of the Entomological Society of Ontario, that at the present time practical remedies are available for all who will take the trouble to ask for them or who have kept themselves posted in the matters which concern vitally the success of their business. But these facts are not appreciated generally by the people most concerned, the agricultural classes. It is an old but true saying:—"We only miss the water when the well runs dry." As a rule, farmers only think of remedies when they find their crops seriously attacked, and they then find that in many cases it is too late to prevent loss Many of the most successful means of protecting crops are methods of prevention and must be put in practice long before the crop to be protected has reached maturity. The farmers of Canada are much to be envied; for they have advantages not surpassed in any part of the world. Yes, sir; not only have we here the glorious climate and magnificent soil necessary for the production of the best agricultural products; but we have as well wise Governments who are doing everything possible to help us in making our operations successful. We have our most active and useful Department of Agriculture, at Toronto, which publishes every year in its annual report, the latest developments with regard to all subjects brought before the various societies subsidized by the Government; these deal with many different agricultural matters, such as our own Entomological Society of Ontario, the Fruit Growers' Association, the Bee-Keepers' Association, the Sheep and Swine-Breeders' Association, Farmers' Institutes and many others. All of these associations receive grants, and the Government publishes their reports for the good of the farmers of the country. Besides this, we have the Agricultural College at Guelph, a grand institution doing excellent work; and, above all, we have the Dominion Experimental Farm system maintained by the Federal Government, which is constantly at work trying to assist the farmers of Canada by testing and examining all subjects which it is thought may better their position and prospects. The publications of all these institutions are issued free of charge and distributed with a liberal hand. In fact I believe, as I have already said, there is no country in the world where more is being done in a wise way to help farmers than is the case to day in Canada. (Applause.)

Is it not folly then on the part of any man in this country not to apprise himself of these facts and put them in practice? To bring the matter back again abruptly to the work of the Society under whose auspices we are gathered here to-night, is it not folly on the part of any farmer in Canada not to find out what are the latest developments—or, as Prof. James has put it, "what is the new agriculture."—with regard to the best methods of protecting himself from loss and of saving his crops from the attacks of the hordes of injurious insects which are ready to levy so heavy a tax upon all that he grows?

Many instances might be cited of the good results which have followed the diligent work of entomologists.

Prof. James has already referred to that delightful incident by which the very existence of a lucrative industry, the cultivation of oranges and other citrus fruits in California, was saved from extinction. This was done by the timely introduction from Australia, by the United States Entomologist, Dr. C. V. Riley, of a small parasitic lady-bird beetle (*Vedalia cardinalis*, Muls.) which preyed upon the injurious Fluted Scale *Icerya Purchasi*, Maskell), Fig. 1, an insect which threatened at one time to destroy all the orange groves in the Pacific States. Another instance of good work of particular interest to Ontario farmers, was the practical remedy first hit upon by Mr. L. O. Howard, now U. S. Entomologist, for fighting the Clover-seed Midge. Our farmers in Western Ontario now cut or feed off the first crop of clover about June 20th, to prevent injury to their seed crop by the Clover-seed Midge. This is undoubtedly the best method of preventing loss, but they do not think that the knowledge of that one fact, which is worth at least half a million dollars a year to Canada, was due to the carefully studied investigations of one man. They know nothing of the arduous and unremitting work which was necessary before

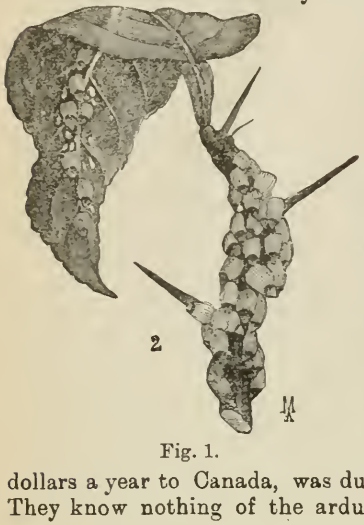

Fig. 1.

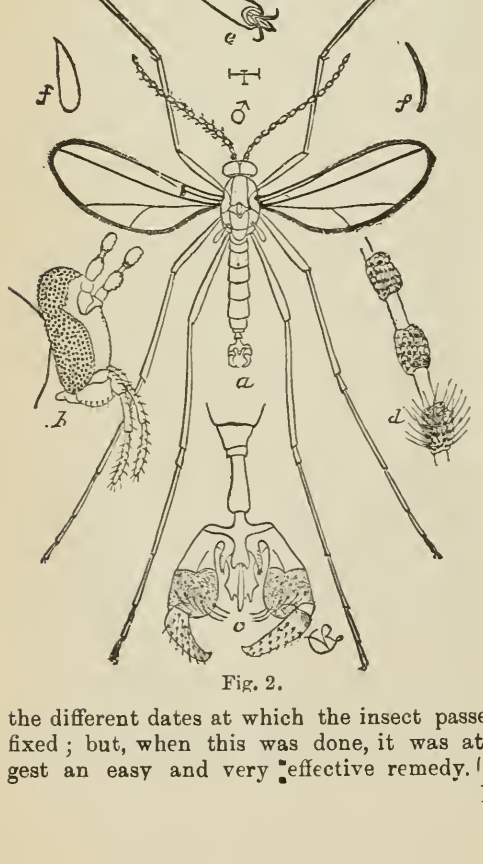

Fig. 2.

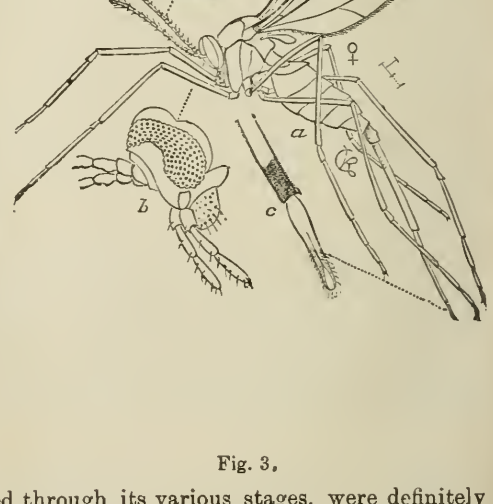

Fig. 3.

the different dates at which the insect passed through its various stages, were definitely fixed; but, when this was done, it was at once possible from this knowledge, to suggest an easy and very effective remedy. The Clover-seed Midge is a minute gnat

(Figs. 2 and 3) which lays its eggs in the forming flower heads of the clover plant in May or early in June and again during July. There are thus two broods of this insect in a season. The larvæ (Fig. 4) of the first brood attain their full growth about the end of June, when they leave the clover heads and go into the ground a short distance to complete their transformations, the perfect flies appearing about the middle of July. The eggs laid by these midges produce the second brood of larvæ which destroy the fall crop of clover seed. Part of this brood matures in September, but the remainder not until the following spring. Experience has taught farmers that the remedy suggested of feeding off their clover fields with cattle and sheep until the beginning or middle of June, or cutting it by the 20th of the same month, is the only way to secure an autumn crop of seed; thus, the grubs of this first brood (the eggs of which were deposited on the growing clover as the heads formed) are destroyed by the cattle eating them, or they dry up with the clover hay which has been cut before they were mature enough to leave the heads of clover and go into the ground to complete their stages. If the clover is left standing in the fields till the end of June, a sufficient time elapses for this latter process to take place, and the perfect flies emerge again just in time to lay their eggs in the opening flowers of the second crop. In this way, the seed of the second crop is destroyed as well as the first.

Fig. 4.

Few appreciate the fact that many of the common remedies which have now come to be pretty generally practised all over Canada, were the outcome of much labour and unremitting attention on the part of men who had devoted years of close study to the matter. The farmer who saves his crop of potatoes by dusting or sprinkling them with a mixture containing Paris green, has small thought for the continuous effort and numerous trials which were necessary before the insecticidal properties of this useful substance were discovered. Paris green, the standard remedy against all mandibulate or biting insects, is a chemical combination containing chiefly arsenic and copper, about 60 per cent. of it being arsenic. It is to this latter it owes most of its virtue as an insecticide. It is, I think, almost an ideal material for the purposes to which it is applied by entomologists. The danger of its being mistaken for some other substance of a harmless nature is reduced to a minimum by its characteristic bright green colour, the colour green being very generally recognized as indicative of poisonous properties. Its insolubility in water and under most conditions to which it is likely to be exposed, renders its use very simple, although this fact also necessitates the constant agitation, during their application, of all liquid mixtures containing it, in order that the Paris green, which is very heavy, may be kept in suspension uniformly through the whole liquid. Its fine state of division makes its dilution either with liquids or dry powders very easy, and its extreme virulence as a poison makes it possible to dilute it very much indeed without loss of its efficacy as an insecticide. It has been discovered of late years that, by mixing an equal weight of quick-lime with this arsenite, the caustic effects which sometimes follow its careless use on vegetation, can be in a large measure prevented. This discovery has simplified immensely the question of the most suitable remedy for mandibulate insects; for now a standard strength of one pound of Paris green, one pound of quick-lime and 200 gallons of water may be recommended for use on all kinds of vegetation. If it be thought more convenient to apply the poison in a dry form, it may be mixed with fifty times its quantity of any dry and finely divided powder.

The easiest way of applying Paris green to orchard trees is in a liquid mixture, by means of a force pump with a spraying nozzle. The good results which have followed the adoption of spraying as a regular orchard operation, have been so remarkable that it is now practised by all progressive fruit growers. There are various kinds of spraying

*Fig. 2*a* represents the male midge enormously magnified; *b*, the head, and *c*, the peculiar clasping organs still further magnified; *d*, the joints of the antennæ; *e*, the claws; *f f*, forms of the scales which are distributed over the wings and body. Fig. 3*a*, represents the female midge similarly magnified; *b*, the head; *c*, the tip of the ovipositor; *d*, a portion of one of the antennæ. The small lines beside the figures give the natural size of the midge. Fig. 4*a*, represents the larva; *b*, the head withdrawn into the first segment. These figures are from drawings by the late Prof. C. V. Riley,

pumps and nozzles, and the latter are quite as important as the former. We have now several good pumps manufactured in Canada; but the best nozzles are the Vermorel and the MacGowan. The former is a modification of the Cyclone nozzle, invented by Prof. Riley and his staff, of the United States Division of Entomology; the principle of this nozzle is that the liquid is forced tangentially into a small chamber, so as to strike the other side of the chamber; it is then forced through a minute central orifice, which has the effect of breaking up the liquid into a very fine spray. Too much importance cannot be attached to the fact that the liquid must be broken up into as fine a spray as possible, so that a very small quantity of the liquid may be used, and that it may be carried all through the foliage and left as a fine dew on the whole surface. In this way sufficient of the poison is deposited to destroy the insect enemies; at the same time, little is used, and there is no injury to the foliage.

During the past summer, there has probably been considerably more spraying done than ever before. This is largely due, of course, to efforts that have been made to bring this excellent method of preventing loss to the notice of fruit growers at the proper season. In Ontario much attention was drawn to the subject last year by some experiments carried out by Mr. John Craig, Horticulturist to the Central Experimental Farm, in a few orchards of Western Ontario. These experiments were very much extended and vigorously prosecuted during the past summer by instruction of the Hon John Dryden, Minister of Agriculture, who recognizes fully the value of this work to the province. The operations were put into the efficient hands of Mr. A. H. Pettit, who visited a great number of stations throughout the province, giving instructions and superintending the spraying of the orchards at regular intervals. The full account of this useful work will be published by the Department; but I may mention that Mr. Pettit has informed me that, on the whole, they have been very satisfactory.

In view of all that has been done by the Government of the country to distribute accurate information as to the best way of preventing injury to fruits by insect and fungous enemies, it certainly is a disgrace to our Canadian fruit growers that apples and other fruits are exposed for sale in this country, and exported to foreign markets in the spotted and blemished condition that is frequently the case. It is disgraceful because it is unnecessary. The two enemies, which are the cause of the greater part of this injury, are the Black Spot, a fungous disease, and the Codling Moth, the larva of which is the well-known "apple worm" Satisfactory remedies for both of these have been found; the Bordeaux mixture for the former, and Paris green for the latter. The cost of spraying these washes over the trees is very little, compared with the great saving which is made in the quantity and quality of the fruit harvested. Although it is true that the number of different kinds of insects which may attack our crops is very large, the actual number of those which are likely to appear every year is comparatively small; of these by far the larger proportion have been already studied and remedies have been published in the official reports, which are available for all who ask for them.

Before closing I must refer to one more subject, namely, the Horn-fly of cattle, which, of late years, has done so much harm among our dairy herds, but about which, from knowing the details of its behaviour since it was introduced into America, entomologists were at once able to give encouragement to dairymen, that in a year or two the virulence of its attacks would be much diminished. This prediction, I am glad to say, has proved correct; while, two years ago, in this very district, the loss in milk supplied to cheese factories was stated to be nearly fifty per cent. of the whole supply, last year it was much less, and during the present season, as far as I can learn, it has been brought down to only five per cent. Next year and thereafter, I hope confidently, that the annoyance from this insect will be reduced so much as to require no more attention than is given to-day to the ordinary cattle fly (*Stomoxys calcitrans*, L.)

Now, Mr. Chairman, I maintain that all this saving, to which I have referred, has been brought about from the development of the *science* of entomology. Science is a terrible word in the eyes of some people; but, after all, it is merely an illustration of the affectation of the age; some people like to use long words where short ones would do as well or better, or to use Latin where plain English would do. Science is a Latin word

which means simply knowledge, and it has been given the special signification of exact knowledge, or the best knowledge. I presume this was what Prof. James meant when he explained to us that the new agriculture was simply an outcome of the necessity, now-a-days, for farmers to have the best possible knowledge and education upon all subjects affecting their calling. I feel sure that everyone here was pleased to hear his kind words about the different societies he referred to, and most particularly proud of what he said of the work of this Society. There is no doubt that special knowledge is now necessary for farmers to compete successfully in the struggle of life. I noticed a statement in the newspaper this morning which well illustrates this fact.

Prof. Henry, one of the best known teachers of agriculture, who is at the present time doing good work at the Wisconsin Agricultural College, obtained his position owing to his practical knowledge of all the details of farming. He has always held that the best men and the best knowledge were necessary for successful farming, and used it as an argument for farmers' sons to remain on their farms and study farming in earnest. There was a vacancy at one of the other agricultural colleges for an agriculturist, and, the story goes, that Prof. Henry was asked if he could send a suitable man to fill the post at $1,500 a year. His answer was that he regretted to say that he could not then find a man properly equipped with all the necessary knowledge of farming, but that if it had been a lawyer or a doctor that was required he could send a whole carload at $600 apiece!

Mr. Fletcher resumed his seat amid much applause, and was followed by the Rev. T. W. Fyles, of Quebec, who read the following paper:

HOW THE FOREST IN THE DISTRICT OF BEDFORD WAS SWEPT AWAY.

By Rev. Thomas W. Fyles, F.L.S., South Quebec.

The remarks contained in this paper apply to that hilly section of the Eastern Townships which lies between the Seigniories on the one hand and Lake Memphremagog on the other, more particularly to the counties of Missisquoi, Shefford and Brome. I have known the locality for more than thirty years, and, in the early part of that period, was intimate with many of the first settlers of the district. Originally this was one vast forest, broken here and there by lakes and beaver meadows. The prevailing trees were the pine (*Pinus strobus* Lin.), the hemlock (*Abies Canadensis* Michx), the spruce (*Abies nigra* Poir), the balsam (*Abies balsamea* Marshall), the cedar (*Thuja occidentalis* Lin.), the tamarack (*Larix Americana* Michx), the maple (*Acer saccharinum* Wang), the beech (*Fagus feruginea* Ait), the elm (*Ulmus Americana* Willd), the basswood (*Tilia Americana* Lin), the white ash (*Fraxinus Americana* Lin), the brown ash (*Fraxinus sambucifolia* Lin.) the birch (*Betula papyracea* Ait), the butternut (*Juglans cinerea* Lin.), the red cherry (*Cerasus Pennsylvanica* Linn), and the black cherry (*Cerasus serotina* Ehrhart). Some spots were named from the nature of the growth which covered them, as Pine Mountain and Spruce Mountain, in Brome.

In early days the staple productions of the district were pot and pearl ashes; and the tree that was found to yield the greatest abundance of these was the elm, and as in those days the law was administered in Montreal, and was an expensive luxury, the early settlers, many of whom were squatters, were allowed to do in the forest very much that which was right in their own eyes. Accordingly regardless of *meum et tuum*, they cut down the elms wherever they could find them, and converted them into "black salts." Consequently the elms of the primeval forest were the first of its trees to disappear. The pines followed next in order. The quality of the timber and the ease with which it was worked brought the white pine into great request. Where there was water transit, as for instance, near Lakes Champlain and Memphremagog, the clearing off of the pine was rapid. And, throughout the district local requirements could be satisfied only with the choicest timber, and all that was not of the best was accounted "vile and

refuse," and was "utterly destroyed." The old court house at Cowansville and the old church at West Shefford, in the soundness and clean grain of the pine lumber employed in them, showed the fastidiousness of their builders' choice of materials.

In the meanwhile, in the struggle for existence, the forest at large was being beaten back; and as Sampson of old said of the Philistines, so the settler might have said of his hacked and dismembered foes, "Heaps upon heaps here they lie!" Blackened piles cumbered the land, to be burned at fitting season, and their remains dragged into new pyres, until, in the language of the people, they were "quite worn out."

The first clearings for actual settlement were made where hardwood timber abounded, for it was well known that hard-wood stumps rot out in seven or eight years, whereas the stumps of black timber endure for a lifetime. The trees that were utilized in the havoc were the white ash, the brown ash and the basswood, which were split into fence rails. Now and then a cherry or a bird's-eye maple found its way to the turner's, to be converted into furniture, but too often indiscriminate destruction made room for the corn field and the potato patch. Often when the maples were spared to form a sugar bush, carelessness and ill usage insured speedy decay. I frequently saw trees tapped by the acre with slanting gashes a foot long and two or three inches deep, a proceeding which impaired the circulation of the sap, producing a diseased condition of the tree, which, as we shall presently see, was peculiarly inviting to the attacks of injurious insects. Those were the days when stately specimens of the basswood (the lumber of which would now be worth $20 per thousand) were felled and notched into sections, which were split off and roughly shaped into sap troughs, the larger portion of the wood being wasted in the process.

As the clearings were enlarged and the dairy afforded more employment and greater profits, the traffic in "black salts" died out, and a second period in the history of the district may be said to have been reached. A third and striking era was opened when, by the enterprise of the late Hon. A. B. Foster, the railway to Waterloo was completed. Not only did farm produce meet with a readier sale, but a demand for hemlock bark, to supply the southern markets, arose, and men turned their attention more closely to the black timber. The short interval between the hoeing season and hay-time was diligently turned to account in peeling bark—the stripped hemlocks being allowed to lie as they had fallen. In consequence tangled slashes often disfigured the uplands, until a second growth—usually of poplar—hid their deformities.

Hitherto we have considered man's work in stripping the land of its bosky covering, but the elements played no unimportant part towards the same end. Fierce winds from the low-lying "French country," compressed in the valleys and defiles, again and again rushed up the mountain sides, and wherever they found a break formed by new settlements, impinged upon the exposed edges of the forest, and tumbled many goodly trees over, as if some huge monster were rooting amongst them. I know one spot where, for some acres, the trees, after a hurricane, lay in swaths, like grain from the scythe of the mower.

But, if the wind slew its thousands, fire may be said to have slain its ten thousands. The heedless and untimely burning of a brush heap often started a conflagration which extended for miles. One of the first inhabitants of Iron Hill told me that the grandest sight he ever saw was the fire rushing up through the pine woods on the western slope of Brome mountain. In May, 1877, I rode with the late Sheriff Cowan from Cowansville to Philipsburg, and men were pulling down fences and "fighting fire" all along the way. And at Philisburg clouds of smoke, sweeping across Missisquoi bay, told that the fire was raging in the State of New York. Great damage was done to the second growth sugar woods by this conflagration, and for several years after maple wood was *a bon marche*.

In addition to man and the elements, an innumerable yet unobtrusive army of sappers and miners worked upon the forest trees—grubs of beetles and horntails, and caterpillars of moths. I shall speak of but a few kinds that attacked (1) the "black timber," (2) the hard woods, (3) the poplars.

(1) I remember standing in the chancel of a new church which I had built in the township of Brome in 1864, and hearing from the floor a slight rasping sound, I watched attentively, and presently the jaws and head of a Buprestis larva (Fig 5*a* and *c*, the larva and head; *b* pupa, *d* beetle), appeared through a hole. I looked around me and saw that there was a row of holes wherever the flooring rested upon a sleeper, and I found that the sleepers had been made of small spruce and hemlock trees hewn a little on the upper side. These trees were the habitations of Buprestidæ, the larvæ of which, having at this time attained their full growth, had gnawed their way through an inch of floor-lining, and an inch and a quarter of spruce boarding to the upper air, that they might enter upon the pupal condition satisfied that a way of exit had been secured for the coming imagoes.

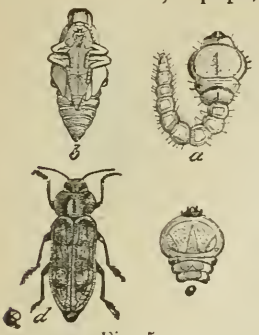

Fig. 5.

There is an insect, a longicorn beetle which, like the "Timberman" of Scotland, finds its food and habitation in the pine. It is *Monohammus Confusor* Kirby (Fig. 6) It is a dark gray, square-hipped insect, an inch and a quarter long, with antennæ of twice that length. This creature often presents itself unexpectedly in strange quarters. One afternoon I was sitting in my study in the rectory at Cowansville, which was then a new building, when suddenly a strange object came down with a great clatter upon the book I was reading. It was *M. confusor*. "Where did you come from?" I said. I looked round and soon discovered a hole recently made in the casing of the door. What an experience that insect had gone through! It had sprung from an egg laid in a crevice of a standing pine. The tree into which it had eaten its way had been cut down, hauled about in the woods, soaked in the mill-pond, and cut up by the circular saw. The boards had been banged about in the piling, had been kiln-dried, and then passed through a planing-machine. That particular board in which the beetle had had its habitation had been worked by hand in "the sash and door factory;" had been planed and fitted, and hammered and painted; and yet—surviving all the rough usage, and escaping all the deadly weapons—there had lain *M. confusor* snugly ensconced in his square-inch, or so, of wood, reserving himself until he could present himself as a gentleman. (Fig. 6.)

Fig. 6.

Another beetle closely related to *M. confusor*, and of similar habits is *Monohammus marmorator* Kirby. It is somewhat smaller than *M. confusor*, and has shorter antennæ. In color it is brown, marbled with pale yellow.

A third insect belonging to the same genus is *Monohammus scutellatus* Say, (Fig. 7). It is called by the French-Canadians, "*Le Forgeron*"—the Blacksmith. It is deep bistre in hue, and has a white scutellum. During the past season (1895) this insect has been unusually numerous and destructive. In the spring one of my neighbors planted an extensive hedge of spruce around his grounds. By the end of summer nearly every scion had been girdled or partially so by the *Forgeron*. The larvæ of the species are even more destructive than the perfect beetles. I have seen a fine, large, spruce tree snap off, two feet from the ground, under pressure from the wind, and, on examination, have found that the stem was tunnelled through and through—scores of the Scutellatus larvæ having mined and countermined it in all directions.

Fig. 7.

(2) The hardwood also affords food and lodging to various insects. The handsome beetle, *Glycobius speciosus* Say (Fig. 8) (whose black and yellow livery is so suggestive of hornets and stings, but is *speciosus* notwithstanding) is frequently found in our wood-sheds, having arrived at perfection in the maple, the best of our fire-wood.

Fig. 8.

But there is a creature that far more extensively assists or accompanies the decay of the hardwood trees. It is one of the Horn-tails, *Tremex columba* Linnæus—an insect belonging to the order hymenoptera. The female *Tremex* is provided with a strong, black, bristle like ovipositor, which proceeds from the centre of the abdomen, and, when not in use lies extended beneath and beyond that section in a fixed and protecting sheath. In depositing its eggs the creature withdraws the ovipositor from its sheath raises its body and drives the appendage through the bark and into the soft wood, laying its eggs therein. As soon as the young grubs are hatched they begin to tunnel the wood, enlarging the bore as they increase in size. By the end of the first season they attain the dimensions of thread worms. The full grown larva is an inch and a half in length and has a waxen appearance. Its mandibles have a ferruginous tinge and its spiracles are light brown. The prop-legs are imperfect and the body terminates in a short spine.

Long observation has led me to believe that the Horn-tails and other borers do not attack *sound and healthy trees.* I stated this belief in a lecture I gave in the Somerville course some years ago. Since then I have read the Rev. J. G. Wood's "Insects at Home," and I am glad to find that some remarks of his bear out my statement. Speaking of the dreaded *Scolytus destructor* Olivier of Europe he says :—

"It is much doubted whether the Scolytus ever attacks a healthy tree, principally, as is conjectured because in such trees the burrows of the insects are filled with sap which not only drives out the beetles but prevents their eggs from being hatched. Still when a tree becomes unhealthy the attacks of the Scolytus prevent it from recovering itself," etc.

A tree struck by lightning, or broken by the wind, or scorched by fire, or hacked and abused by man is the chosen object of insect spoilers.

Fig. 9.

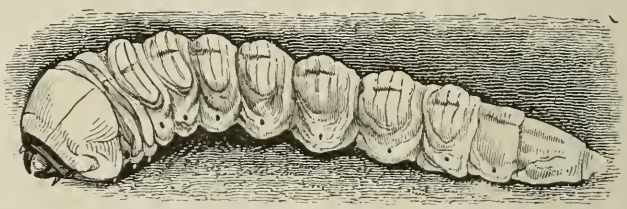

Fig. 10.

I have spoken of the waste of hemlock which followed upon the first demands for tanbark. Felled hemlock trees that are not soon sent to the sawyer's, are sure to be confiscated by a sawyer of another kind, *Prionus unicolor*, as Harris calls it—the one-coloured sawyer—the *Orthosoma brunneum* of Forster. (Fig. 9.) For nature not only abhors a vacuum ; she also abhors waste. A standing hemlock in the last stage of its existence

produces the *Boletus igniarius* which nourishes the Toad Beetle, *Boletophagus corticola*, Say. A fallen hemlock becomes the food of the Prionus grubs. (Fig. 10.) The creatures are well known to every farmer who has had to clear his land of the half rotten trophies of his early triumphs over the wilderness.

It yet remains for me to say a few words (3) concerning a borer which attacks the poplars, the latest growth on neglected brush lands. The insect is *Cossus centerensis*, Lintner. It belongs to the order lepidoptera. The perfect insect is a large moth with crape-like wings, dark grey in colour, reticulated with fine black lines It makes its appearance in July. The male is smaller than the female. The presence of the larva is betrayed by the *frass*, or half digested sawdust, which it throws out, in early summer, from its burrow in the tree. On attaining its full size, the caterpillar retires some inches into the tree, and assumes its chrysalis condition. In due time, the chrysalis, by means of a series of serrated rings on its body, works it way along the tunnel bored by the larva, to the surface of the tree, and forces itself through, so as to clear its wing cases. The skin then bursts, and the perfect insect makes its escape.

In bringing this brief history to a conclusion I would bear in mind that the aim of all historians should be to convert the mistakes of the past into lessons for the future; and I would offer a few practical hints:—

I. Believing in the powers of the press, I would commend to all newspaper editors the practice of devoting a column to the discussion of rural affairs. Under a judicious editor the practice is invaluable, for many men in country places read the newspaper, and read little else.

II. In all normal and training schools, teachers should be led to see the importance of training the young in habits of prudence, forethought and economy For want of the exercise of such qualities in his early days many a farmer has now to buy his firewood, or to obtain it from a distance at the expense of much time and labour.

III. I would recommend farmers to thin out their sugar woods, plantations and copses, so that the trees may have ample room to spread their roots and obtain a firm hold on the earth, that they may not easily be overturned by a tempest.

IV. I should say, do not over-prune, and prune in the winter when the sap has ceased to work. Cover all wounds with grafting wax or oil-paint. Neglect of these precautions will throw the trees into a condition which will assuredly invite the attacks of destructive insects.

Lastly, I should say, tap your maple trees with care; use a duck-bill augur and cedar spouts, which "give" and do not split the bark.

A cordial vote of thanks to the Mayor, for his kindness in presiding on the occasion and allowing the use of the city hall for the meeting, was proposed by Mr. Dearness, who spoke very happily of the pleasure and instruction which they had all received from the addresses of the evening, and was seconded by Mr. Saunders, and adopted by the meeting with much applause.

Mr. E. R. Cameron then moved, seconded by Mr. S. H. Craig, a vote of thanks to the speakers who had come from a distance to address them, and had afforded them so much gratification. After putting the motion, the meeting was closed with a few pleasant remarks from the Mayor, who wished the Entomological Society of Ontario a long continued and prosperous career.

THURSDAY, NOVEMBER 28TH.—MORNING SESSION.

The meeting was called to order at 10 o'clock, a.m., the chair being taken by Mr. Fletcher. The reports of the various sections of the Society were presented and read by their respective secretaries.

REPORT OF THE BOTANICAL SECTION.

The Botanical Section beg to submit the following report for the summer of 1895:

Regular weekly meetings of the section were held from April 22nd to October 19th. The average attendance was considerably in advance of that of the previous year. A number of the public school teachers of the city joined the Society, and became industrious workers in our section. For the benefit of those just beginning the study of botany, a part of each meeting was devoted to the study of some important natural order, illustrated by typical specimens collected by the members.

Papers upon the following subjects were read at different meetings:

1. "The Humanity or Civilization of Plants and Flowers," Prof. J. H. Bowman.

2. "The Relation of Chlorophyll to the Forms of Plants," W. T. McClement.

3. "The Distribution of Plants in Ontario, with Special Reference to the London District," Mr. J. A. Balkwill.

4. "The Dissemination of Seeds," W. T. McClement.

One public field day was held, July 1st, when the members and their friends visited Komoka, and made large and beautiful collections, the feature of the day being the abundance of *Cypripedium spectabile*.

During the season the following plants were added to the local list:

Spergula arvensis—Mr. J. A. Balkwill.

Arctostaphylos Uva-ursi—Prof. J. Dearness.

The section have deemed it wise to direct their attention to the arrangement of a Flora of Middlesex county. A good start has been made toward this, as we have the list of *Polypetalous* and *Gamopetalous Exogens* ready for final revision. We have to thank Mr. Fletcher for a number of rare and interesting plants from the Ottawa district, which he donated to the Herbarium.

W. T. McClement, Secretary.

Mr. Fletcher spoke of the value of the proposed Flora of the County of Middlesex. He also stated that *Spergula arvensis*, which had recently been found in the neighborhood of London, was recommended by the Michigan State Agricultural College for introduction as a fodder plant, but in Europe it was regarded as a persistent and troublesome weed, and was found to bear the same character in some parts of Canada. He strongly deprecated its introduction by farmers into this country.

REPORT OF THE GEOLOGICAL SECTION OF THE ENTOMOLOGICAL SOCIETY FOR THE YEAR 1894-95.

We have much pleasure in reporting to your honorable body that the Geological Section has had a most prosperous year. Our membership has increased; the average attendance at our meetings has been greater than during any previous year.

Many valuable additions have been made to our private collections since last we reported progress, but we are still looking forward to the formation of a central collection in our city, to which the members of our Society and all our citizens may have free access.

The section would suggest that it would be a great advantage to students of mineralogy if some steps could be taken by which the small number of Geological and Natural History societies in the Province could be provided with small collections of accurately named specimens of the chief economic minerals.

The members of our section have made trips to a number of places of geological interest, including Rockwood, Elora, Guelph, North Dorchester, and the mammoth and colossal Caves of Kentucky.

Valuable papers have been read before our section, showing the methods of gold mining in Australia, Colorado, Ecquador and Madoc.

Addresses on the following subjects have been made by various members of our Society:

1 "Trip to St. Joseph's Island." By Mr. Morris.
2. "Australian Gold Fields," Mr. Webb.
3. "Crystallography," Dr. Wilson.
4. "Canoe Cruise on Lake Nipissing," Mr. Allison.
5. "Physical Basis of Knowledge," Mr. Scarrow.
6. "Correlation of Forces," Mr. B. Green.
7. "Trip to Mammoth Cave," Dr. Wolverton.

Signed on behalf of the Geological Section by

G. F. Sherwood, Secretary. S. Woolverton, Chairman.

REPORT OF THE MICROSCOPICAL SECTION OF THE ENTOMOLOGICAL SOCIETY.

The season opened with the first meeting on October 12th, and continued every second week till March 29th, at which time, as is usual, we discontinued in favour of the Botanical Section, of which nearly all the microscopists are active members.

Regular Meetings.—There have been twelve such. Interest has been well sustained throughout the season, meetings regular, attendance good, subjects excellent and well presented. More than usual the members have engaged in practical work. Among the subjects were: "The Study, Dissection and Mounting of Earthworms," led by Dr. Hotson; "Fungi" (Hymenomycetes), and "Wood Sectioning, Staining and Mounting," led by Prof. Dearness; "Insect Mounting Without Pressure," also "Cell Building," by Mr. Rennie; "Brownian Movement," led by Mr. W. T. McClement; "Fluid Mounting of Green Algæ," also "Collection and Mounting of Diatoms," led by Jas. H. Bowman. Very many microscopical plants were brought in by members and furnished many an enjoyable hour.

Open Meetings—Of these, two were held, and, as usual, attracted a large attendance and were well appreciated by those for whom they were intended. In this connection we would say that we find our present quarters very ill-suited for this class of meeting. Had we held the same in some more convenient place, no doubt a great and favorable difference would be observed.

Outings.—These are not so frequent as they might, and would be, if it were not that we occupy only winter months. We have, however, the benefit of the botanists' excursions in the summer time as our members who are botanists are always thinking of our section and preserve their finds and work up their subject in connection with them for our meeting season.

Jas. H. Bowman,
Secretary of Section.

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

By the Rev. Thomas W. Fyles, F.L.S., Delegate.

I beg to state respectfully that the Society I have the honour to serve on this important occasion, is in a healthy and growing condition—sound financially, possessing a large amount of *materiel*, and held in estimation at home and abroad.

It is to be expected that the subject of economic entomology will commend itself more and more amongst the intelligent members of a fruit growing and agricultural community. The insect enemies of the farmer and gardener are numerous and persevering, and accomplish incalculable harm ; and a society that studies the life histories of these foes, and searches for checks upon their efforts, can hardly fail to win adherents and to command support. Accordingly we find that at the thirty-second annual meeting of our Society the council was able to congratulate the members upon "the steady increase in numbers which continued to take place, and the hearty interest that was maintained in the various departments of the Society's work."

The headquarters of the association are in London, the chief town of one of the mo important agricultural and horticultural sections of Ontario, and a fitting centre for a society which is aided by the Ontario Government, and is intended to promulgate practical information amongst the cultivators of the soil, as well as to foster scientific research. The Government grant made to the Society annually is $1,000.

That the Society is doing the work expected from it, and doing it well, may be shewn on sufficient testimony. Thus Mr. L O. Howard, Chief Entomologist of the Department of Agriculture, Washington, says of it : "The Society has conscientiously complied with the conditions of the grant. Its reports published annually have greatly increased in size, and in the general interest of their contents. They have contained much matter of economic value as well as of educational interest." And the editor of an English magazine speaks of the report last issued as one of more interest to him than all others received from America. Doubtless the Society, with a larger grant, could accomplish more good.

The annual meeting, to which I have referred, was held on the seventh and eighth days of November last. The value of the addresses and of the papers read, and the beauty and rarity of the specimens exhibited on this occasion were fully appreciated by those who were privileged to attend. The President's address was particularly valuable as an instructive sketch, *historical* and *geographical*, of the Society and its work. It was learnt from it that the society has observers and correspondents from east to west throughout this vast Dominion—from St. John, N. B , and Halifax, N. S., to Esquimalt in British Columbia and Masset in Queen Charlotte Islands. A very valuable paper on "The Rhopolocera of the Eastern Provinces of Canada," was read on this occasion by the Rev. Dr. Bethune, editor of the *Canadian Entomologist* It gave a complete list of species and the names of the localities in which each local kind has been taken with—as far as is known—the food plants of the different species.

The titles of the other papers read at the meeting are as follows :—

"Insects Collected in Bermuda During the Winter of 1894," by Gamble Geddes, Toronto.

"Common Names for Butterflies—Shall We Have Them?" by H. H. Lyman, Montreal.

"The Pitcher-Plant Moth," by James Fletcher, Ottawa.

"Catastega aceriella *Clemens*, Semasia signatana *Clemens*," by the Rev. Thomas W. Fyles, South Quebec.

"Notes on a Few Canadian Coleoptera," by W. Hague Harrington, F.R.S.C., Ottawa.

"Food, Feeders, and Fed," by Rev. Thomas W. Fyles, F.L.S., South Quebec.

"An Attack of Ephestia interpunctella," by H. A. Stevenson, London.

"The Economic Value of Parasitism," by F. M. Webster.

"The Re appearance of Pieris Protodice *Boisd.*," by J. Alston Moffat, London, Ont.

"Remarks on the Structure of the Undeveloped Wings of the Saturniidæ," by J. Alston Moffat.

"Bordeaux Mixture as a Deterrent Against the Flea Beetles," by L. R. Jones, Burlington, Vermont.

"The Gypsy Moth," by James Fletcher, Ottawa.

'The San Jose Scale," by James Fletcher, Ottawa.

"Injurious Fruit Insects of the Year 1894," by James Fletcher, Ottawa.

The twenty-fifth annual report, issued by the Society, contains portraits of Professor William Saunders, F.R S.C., President of the Society from 1875 to 1886, and Augustus Radcliffe Grote, A.M., one of the Society's honorary members, and it is also illustrated with sixty figures of insects.

Besides the President's address and the papers above-mentioned, the report contains .—

The minutes of the meeting.

The Report of the Librarian and Curator, Mr. J. Alston Moffat.

The Report of the Montreal Branch, presented by Mr. H. H. Lyman, President, and signed by Mr. A. F. Winn, Secretary.

The Report of the Geological Section, presented by Dr. S. Woolverton, Vice-Chairman.

The Report of the Botanical Section, presented by Mr. W. F. McClement, Secretary.

The Report of the Delegate to the Royal Society of Canada.

A very valuable abstract of the proceedings of the sixth annual meeting of the Association of Economic Entomologists, supplied by Mr. L. O. Howard, Entomologist of the Department of Agriculture, Washington, and Mr. C. L Marlatt, Secretary of the meeting; and a number of interesting notices, critical, biographical, etc.

This report is distributed "not only to our own members, but to every member of the Fruit Growers' Association, to members of Parliament, the Mechanics' Institutes, etc., making an issue of 6,000 copies, (W. H. Harrington, *Canadian Entomologist*, vol. XXVI., p. 2.)

The Society's library now numbers 1,361 volumes—seventy-seven having been added in the course of the year.

Important additions have been made to the Society's collections of insects. In its cabinets may now be seen representatives of 1,077 species duly classified and named.

The Society is fortunate in retaining the services of Mr. J. Alston Moffat as Librarian and Curator. By his methodical habits, his manual skill in mounting specimens, and his extensive knowledge of the lepidoptera, Mr. Moffat is peculiarly fitted for the position he holds.

During the year the various sections of the Society have held field days at St. Mary's, Dorchester, Kilworth, Byron, Komoka, Kettle Point (Lake Huron), Ilderton, Thedford, Beechville, Woodstock, Mud Lake and other places. The value from an educational point of view of such expeditions in a neighborhood that possesses such experienced scientific guides and instructors as Messrs. W. E. Saunders, J. M. Denton, J. A. Balkwill, J. W. Dearness, J. H, Bowman, Dr. S. Wolverton, R. W. Rennie, all long connected with the Society, besides younger and enthusiastic men, is beyond estimation.

The *Canadian Entomologist* has reached its twenty-seventh year. The volume for 1894 contains articles from sixty-one contributors—fourteen residing in Canada, forty in the United States, five in England, one in Germany and one in Sweden. In its pages are described no less than seven new genera and ninety-five new species of insects. The magazine continues under the able management of the Rev. C. J. S. Bethune, D.C.L, F.R.S.C., etc.; and it is a striking proof of the courage and perseverance of its editor that notwithstanding the cares and anxieties that must have thronged him, through the destruction by fire of his noble school buildings and the beautiful chapel attached to them, the *Canadian Entomologist* has made its appearance as regularly as ever and as carefully edited.

Hitherto the Entomological Society of Ontario has studied the life-histories of insects, the methods of attack of the pests of the homestead, the storehouse, the garden, the orchard, the field and the forest; the ways for circumventing these foes; and the nature and application of insecticides. Much, no doubt, remains to be learned on all these subjects. But the attention of naturalists has of late been drawn to a new and most important matter. It is, to use the heading of one of the papers published in the Society's report that has been mentioned, *The Economic Value of Parasitism.* It is well to know how to meet enemies ourselves, but it is better sometimes to know how to direct faithful allies against them. If the parasite (*Diplosis grassator* Fyles), which keeps down the numbers of the Philloxera in this country, had been carried over to Europe, it would doubtless have saved many a vineyard that has disappeared. The introduction of the Australian Lady-bird (*Vedalia cardinalis* Mulsant), the foe of the "Fluted Scale," has probably saved the orange groves of California from extinction. The predaceous beetle (*Clerus formicarius* Linnæus) has lately been introduced into Western Virginia by Professor Hopkins, as a check upon the "Borers" that have wrought such destruction in the spruce forests of that country, And this bringing about of good by the directing of insect agents is only in its beginning. As our knowledge increases we shall in all probability be able to gather and control forces that at present are but little understood.

Election of Officers.

The following gentlemen were elected officers for the ensuing year:

President—J. W. Dearness, London.

Vice-President—H. H. Lyman, Montreal.

Secretary—W. E. Saunders, London.

Treasurer—J. A. Balkwill, London.

Directors—Division 1. James Fletcher, F.L.S., F.R.S.C., Ottawa
" 2. Rev. C. J. S. Bethune, F.R.S.C., Port Hope.
" 3. Gamble Geddes, Toronto.
" 4. A. H. Kilman, Ridgeway.
" 5. R. W. Rennie, London.

Librarian and Curator—J. Alston Moffat, London.

Editor of the "Canadian Entomologist"—Rev. C. J. S. Bethune, M.A., D.C.L., Port Hope.

Editing Committee—J. Fletcher, Ottawa; H. H. Lyman, Montreal; Rev. T. W. Fyles, South Quebec; J. M. Denton, London.

Delegate to the Royal Society—J. D. Evans, Trenton.

Committee on Field Days—Dr. Woolverton, Messrs. Sherwood, McClement, Balkwill, W. Stevenson, W. E. Saunders, Anderson, Elliott, Rennie, and Bowman, London.

Auditors—J. M. Denton and J. H. Bowman, London.

Field Days.

A discussion on Field Days and the best methods of conducting them was participated in by most of the members present. Mr. Fletcher described the plan adopted by the Field Naturalists' Club of Ottawa, which had proved very successful. It was decided that every effort should be made next summer to develope the system and that the annual meeting of the Society should, if possible, be held in August in order to have a general outing for the members in connection with it.

The Canadian Entomologist.

A discussion was next carried on by Messrs. Balkwill, Rennie, Dearness, and Fletcher as to the possibility of reducing the expense incurred in the publication of the *Canadian Entomologist*. The treasurer and editor were instructed to confer with the publishers on the subject. Mr. Dearness suggested that a leaflet should be printed for enclosure in correspondence, setting forth the advantages of membership in the Society.

AFTERNOON SESSION.

The meeting was called to order by the President, Mr. J. W. Dearness, at 3 o'clock, p.m.

Papers were presented by Mr. Moffat on "Observations on the Season of 1895," "Variation, with Special Reference to Insects," and "The Growth of the Wings of a Luna Moth."

Mr. Fletcher gave an interesting address on his trip to British Columbia during the past summer, which was undertaken for the purpose of collecting and observing insects and plants throughout the region traversed. He illustrated his remarks by exhibiting a beautiful collection of dried plants that he had made, and several boxes of rare and remarkable insects.

A fine specimen of the exceedingly rare elater, *Sarpedon scabrosus*, was exhibited by Mr. J. D. Evans, who had taken it during the past summer at Trenton, Ont.

The receipt of valuable donations to the Society's collection of insects was announced from the Rev. G. W. Taylor, Nanaimo, B.C, Mr. E. Firmstone Heath, the Hermitage, Cartwright, Manitoba, and C. de Blois Green, Osoyoos, B.C., and the hearty thanks of the Society were accorded to the donors. Dr. Bethune stated that arrangements had been made for the exchange of publications from the year 1868 with the Entomological Society of France, whose "Annals" would form a very important and valuable addition to the library.

Much time was very enjoyably spent by the members during both the days of meeting in exhibiting rare captures, examining the cabinets and books of the Society, and comparing notes on many interesting entomological subjects.

INSECT INJURIES OF THE YEAR 1895.

By James Fletcher, Ottawa.

The insect injuries to the crops of the province during the past season have been almost entirely by well-known pests.

Cereals.—Grain crops have suffered very little; the most serious injuries were by "grasshoppers." These developed in large numbers all through those districts where

drought prevailed, and did much harm to grass, oats and barley. The species which were most abundant were *Melanoplus femur-rubrum*, *M. atlanis* and *M. bivittatus*. Cutworms (Fig. 11) were less complained of than usual, taking the province as a whole. *Hadena arctica* and *Hadena devastatrix* occurred abundantly in the extreme western counties. Hessian fly was sent in from the Muskoka district; and also the joint worm (*Isosoma hordei*),Fig. 12, the latter attacking wheat and injuring it to the extent of five per cent. at Meaford, Ont.

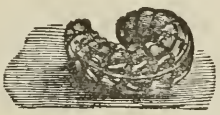

Fig. 11.

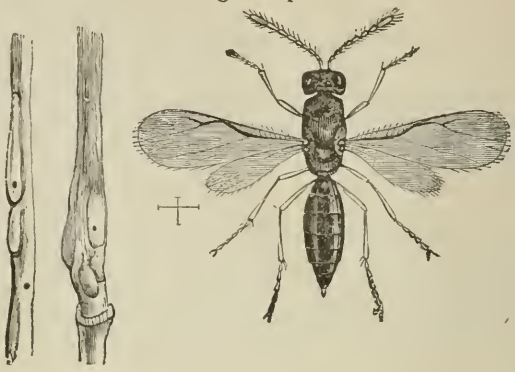

Fig. 12.

Fodder Plants.—Under this head, undoubtedly the greatest damage was done by grasshoppers, and farmers will do well next season to examine their grass lands early in the season before the grass is too high, to see if there are many of the young, and if so, to use one of the different "hopper-dozers" or oil pans which are used to such good effect in the Western States. The Pea Moth has continued its injuries, and up to the present no practical remedy has been discovered. I commend this insect to the particular attention of our members. Although known as so abundant and injurious for the past twenty years, the perfect insect in this country has never yet been identified.

Roots.—The Colorado Potato-beetle still exists in great numbers, but with so cheap and effective a remedy as Paris green, it cannot be considered a serious enemy except by the lazy or careless The larva of *Gortyna cataphracta* was sent in from three or four places in Eastern Ontario as having bored into the stalks of potatoes, tomatoes and many other garden plants. A new attack on potatoes reported this year for the first time was by *Otiorhynchus ovatus*, which was sent from Fenella, Ont., by Mr J. B. Brook, who had found it girdling the stems of his potatoes. The same insect was found injuring young apples, pears and currants at Arthabaskaville, Que. Turnips were badly attacked all over the province by the Turnip Aphis, and many reports were received. There is no very satisfactory remedy for this insect. Careful watch should be kept in August when hoeing and thinning turnips At that time the colonies are small and few in number, and if care be taken to destroy them then, much may be done to control the outbreak. Spraying with kerosene emulsion was found to be useful when the colonies were not too numerous. A tobacco and soap wash would be equally effective. The Diamond-back Moth (*Plutella cruciferarum*) was also abundant both on turnips and cabbages, but affected the crop very little. Cabbage and Onion Root-maggots were as usual abundant in many places, and did much harm The Imported White Cabbage Butterfly (*Pieris rapæ*), Fig. 13, is not now considered a very serious enemy where the use of pyrethrum powder and flour (one to four) is practised. The best way to apply the remedy is to dust it over the cabbages as soon as the work of the larvæ is noticed, by means of small hand bellows or from a muslin bag. It cannot be too strongly insisted upon that Paris green must never be used on cabbages.

Fig. 13.

Fruits.—The injuries to fruits cannot be said, as compared with other years, to have been very serious. Most of the usual pests have put in an appearance and done some harm, but the more general adoption of the excellent practice of spraying regularly is having a noticeable

effect. Codling moth, Plum curculio, Canker-worm, Eye-spotted Bud-moth, Tent caterpillars and Fall Web-worm have been abundant in some places, but their numbers have been brought down considerably wherever spraying with the arsenites was resorted to.

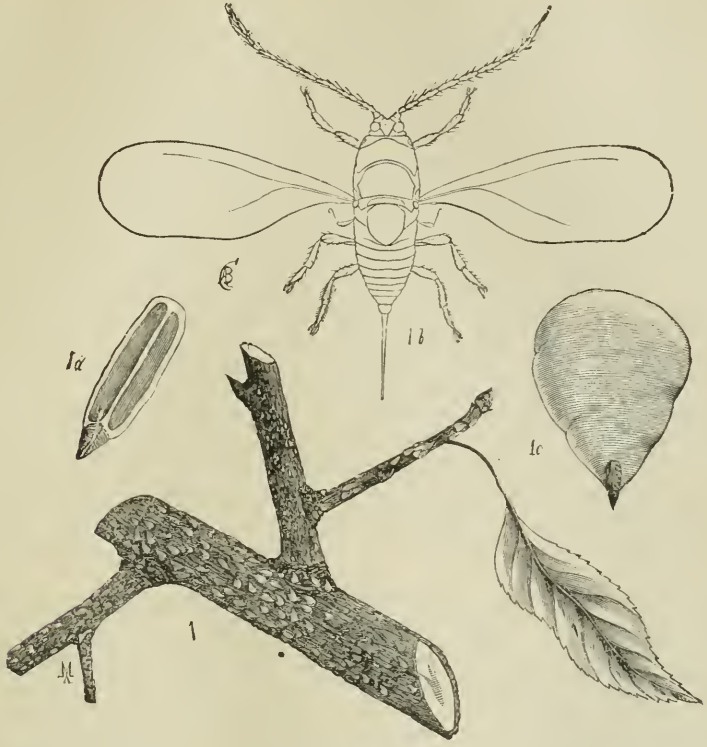

Fig. 14.—1, twig with scales; 1*a*, scale of male; 1*b*, winged male; 1*c*, scale of female—highly magnified.

The Oyster-Shell Bark-louse is abundant throughout the province, and where orchards are neglected does much harm. Spraying with kerosene emulsion when the young insects emerge from the old scales, about 1st June, is the best remedy. The Scurfy Bark-louse, *Chionaspis furfurus*, Fig. 14, was sent from Essex County. One tree was badly infested, but a thorough spraying with kerosene emulsion entirely cleaned it.

The New York Plum-scale (*Lecanium*) has been found, on enquiry, to be present to some extent all through the Niagara peninsula and in some other western counties. Only two bad occurrences have been discovered, and I am much pleased to be able to report that these have both been eradicated by treatment with kerosene emulsion. The life-history of this scale is quite different from that of the Oyster-Shell Bark-louse. In this species, the young emerge at the end of June and make their way out on to the foliage, where they remain without growing much until autumn; they then crawl back again on to the twigs and branches and hibernate there. When revived by the return of spring, they move again and fix themselves to the young wood, chiefly on the lower side of the smaller branches. They grow very rapidly in spring, and the tiny flat scales which hibernated, soon become large, conspicuous, dark brown, hemispherical scales, varying somewhat in size, but about one-eighth to one-sixth of an inch in length by about half of that length in height. The basal outline is ovate or almost round, being very nearly as wide as long. This insect has been carefully studied by Mr. Slingerland of Cornell University, and the remedy which he suggested has been used very satisfactorily both at Queenston and Grimsby, where the two serious outbreaks referred to above occurred.

This treatment is to spray infested trees at least twice during the winter with a strong kerosene emulsion wash—the Riley-Hubbard emulsion diluted with only four parts of water. This did no harm to the plum trees, but quite destroyed the scales.

Canker-worms (*Anisopteryx*). There has been a good deal of enquiry during the past season as to the best way to treat Canker-worms in orchards There can be no doubt about the superiority of spraying with Paris-green over all other methods, where the trees are small enough to be reached easily with an ordinary spraying nozzle; but where trees are old and large, some growers still prefer to use the old method of banding the trunks of the trees with printers' ink and oil or some other viscid material. Mr. O. T. Springer, of Burlington, Ont., uses a mixture consisting of castor oil, two pounds and resin, three pounds, heated and thoroughly mixed. This is painted directly on the tree trunks in autumn and spring. In Nova Scotia, printers' ink is reduced with fish oil, and this is painted on strips of thick paper which have been previously tacked round the trunks. Mr. E. J. Armstrong, of Church Street, Cornwallis, in the Annapolis valley, informed me, when enquiring why he preferred banding to spraying, that the chief reasons were that the trees in Nova Scotia were large, and it was the practice to grow other crops in the orchards, and, besides, injury had been done by careless spraying. He gives the cost of this treatment about as follows: Printers' ink is about twelve cents a pound; twenty pounds of ink will require four gallons of fish oil, at fifty cents a gallon. This amount will answer for an orchard of five acres, the trees being of about twenty or thirty years. It will require about fifteen pounds of paper, at four cents a pound. This is cut with a saw from the roll in strips six inches in width. Two men, armed with a sharp knife and a tack hammer, can go over an orchard of five acres in half a day, the first man measuring the tree and cutting off sufficient paper to band it, the second one tacking it on. The ink is applied in autumn and spring with a paint brush, and the paper put on in autumn is ready for the next spring.

The Cigar Case-bearer (*Coleophora Fletcherella*), which has done so much harm to apples in Ontario and Nova Scotia during the past four or five years, and of which I spoke last year, has been the cause of much loss again this year. Spraying with kerosene emulsion, directly the young caterpillars begin to move out on to the buds in spring and spraying regularly two or three times at short intervals of four or five days with Paris green, one pound to 200 gallons, have both been attended with a measure of success; but this is an exceedingly difficult insect to destroy, owing to the fact that the caterpillar feeds mostly on the inside tissues of the leaf, merely eating a small hole through the outside skin so as to get at the inner tissues, which it mines out in a large blotch mine as far as it can extend its body from its case. Mr. Edwin Worden, of Oshawa, has, during the past summer, sprayed his trees with a Paris green and lye wash, which he writes me has been most satisfactory. The first time he used this remedy he sprayed with concentrated lye only. This was about the middle of May, 1894, and Mr. Worden was under the impression that the application had not killed many of the Case-bearers; but the effect was very beneficial, and he could see distinctly where the spraying had been done by the cleanness of the trees from moss and Oyster-Shell Bark-louse. Last summer he sprayed again with three cans of concentrated lye and one-quarter pound Paris green in forty-five gallons of water, and secured the best of results; he particularly states that the lye did not injure the foliage at all. This spraying was done in the beginning of June, and Mr. Worden's object was to destroy at the same time the Codling Moth, the Cigar Case-bearer and the Oyster-Shell Bark-louse. No doubt many other pests would be killed at the same time, such as the Canker-worm, Eye-spotted Bud-moth, Leaf Rollers, etc.

The Peach Bark-borer (*Phlœotribus liminaris*) which has for some years done so much harm in the peach orchards of the Niagara Peninsula, has this year been successfully treated by Mr. C. E. Fisher, of Queenston. Noticing that the perfect beetles became active very early in the spring, he washed his trees then with a strong alkaline wash to which carbolic acid had been added. He made his wash as follows: Five pounds of washing soda, three quarts of soft soap, and enough water to make six gallons. Air-slaked lime was then added sufficient to make it of the consistency of thick paint. To all this was added three tablespoonfuls of Paris green and one ounce of carbolic acid.

This mixture was applied with a whitewash brush, thoroughly covering the entire trunk of the tree and a few inches up on the limbs. Mr. Fisher reports that at the end of the season he is quite satisfied with the results of the treatment. It would appear from what I have just said that two applications of this mixture, the first one being made as soon as the beetles become active, sometimes as early as March, and another six weeks later, would provide us with an effective remedy for this little pest, which for some years has done considerable harm in our Canadian peach orchards.

Black Peach Aphis (*Aphis persicæ-niger*).—The only new fruit pest of any importance which has appeared in the province during the past season is the Black Peach Aphis, of which specimens have been sent in from two orchards at Leamington, in Essex county. The insect has undoubtedly been imported from the United States on young nursery stock. There are two forms of this insect, one attacking the twigs, the other, more injurious and much more difficult to treat, occurring on the roots. Prof. John B. Smith, of New Brunswick, N. J., who has studied this Aphis a great deal, states that the form on the twigs is easily controlled with kerosene emulsion; and the underground form he has successfully treated with heavy top dressings of kainit. He recommends for light soils in New Jersey about ten pounds per tree, covering the probable extent of the root system, This is for a bearing tree from four to six inches in diameter, and the time for applying the kainit is in the spring, when the trees are leafing out. Prof. Smith states that "the kainit has proved successful in our orchards, wherever used." Another method of treatment which has been recommended is to dig in tobacco waste around the roots.

Fig. 15.

Fig. 16.

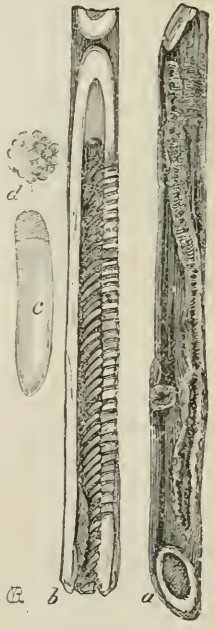

Fig. 17.

Fig. 15, male; 16, female; 17, injured canes.

Mr. Woolverton, the energetic Secretary of our sister society, the Fruit Growers' Association of Ontario, states that the Pear Leaf Blister Mite (*Phytoptus pyri*) is rapidly gaining ground in the Niagara district, the corky dark-colored galls being conspicuous on the foliage of most pear trees. On account of the diminutive size of the mite which causes these blister-like galls and from the fact that it works inside them out of sight, it is seldom recognized as the cause of the injury, many people attributing the origin of the galls to

some parasitic fungus. The treatment which has been recommended for this pest is spraying the trees with kerosene emulsion just as the buds burst in spring. On the Pacific Coast, where it is also very prevalent, good results have been obtained with a winter wash consisting of sulphur one pound, lime two pounds, salt one pound, and water three gallons. The manufacture of this wash is described in detail in an article on the San Jose Scale published in our last annual report.

The Snowy Tree-Cricket (*Œcanthus niveus*), or one of the allied species, is doing much harm in raspberry plantations about Hamilton. Several specimens of injured canes have been sent to me which had been pierced by the females when depositing their eggs. Some of these had split open down the whole length of the punctured area, and the canes in all cases were much weakened. This insect is claimed to be predaceous, and Miss Mary Murtfeldt, who I think was the first to observe this fact, says that they feed almost entirely upon Aphides and other minute pests and make ample compensation for all the injury that they do, and that they should be considered beneficial rather than injurious. Around Hamilton, however, I am told by Mr. Wm. McEvoy, of Woodburn, Ont., that the injuries to raspberry canes are serious. The only remedy which seems practicable is the pruning and burning of the injured canes early in spring before the eggs hatch, for the insect passes the winter in the egg state inside the canes. Figs. 15, 16 and 17.

The insects I have mentioned I think will include all the worst enemies which have been brought before my notice during the season as having occurred injuriously in the province. There were, of course, several others, but none requiring special mention, except, perhaps, the Carpet Beetle (*Anthrenus scrophulariæ*), Fig. 18, which is gradually extending its range, and the Mediterranean Flour Moth (*Ephestia Kühniella*), Fig. 19, for which a

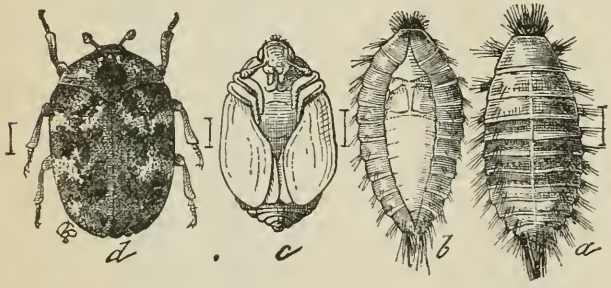

Fig. 18.

Fig. 18, *a* and *b*, larva; *c*, pupa; *d*, beetle.

Fig. 19.

(a). Moth (imago) magnified.
(b). Outline, showing natural size.

new locality has been found at Valleyfield, Que. Specimens were sent to me from a mill early in October, and instructions were promptly given as to the best steps to take to clean the mill. These were adopted, and in December I received a report from the manager that the outbreak had been suppressed. I think it probable that he may have taken too favourable a view of the matter, and I have urged upon him the necessity of keeping a constant watch for any appearance of the insect. This is not only an extremely injurious pest, but an exceedingly difficult one to eradicate. I find that it occurs more or less plentifully in some of our large milling centres, and, where special efforts are not put forth to control it, loss is sustained.

THE GROWTH OF THE WINGS OF A LUNA MOTH.

By J. A. Moffat, London, Ont.

In the afternoon of March 5th, 1895, I heard a noise amongst my cocoons. On examination I found that it proceeded from the cocoon of an *Actias Luna*, Fig. 20, which had been given to me early in the season. It was extremely thin; when I took it up I could see the movements of the imago through it. It was revolving as well as scratching

vigorously. It seemed to be conscious of its imprisonment, and appeared so eager to escape, it made me feel uncomfortable, so I opened a hole in the cocoon, out of which it crawled on to a finger which I extended for its convenience, thus missing an opportunity of seeing it dig its own way out. It was perfectly dry, and left no moisture on the cocoon or pupa case. I gave it a position to suspend from, where I could observe it conveniently. I looked at the time; it was a quarter to three. It did not show the slightest inclination to travel.

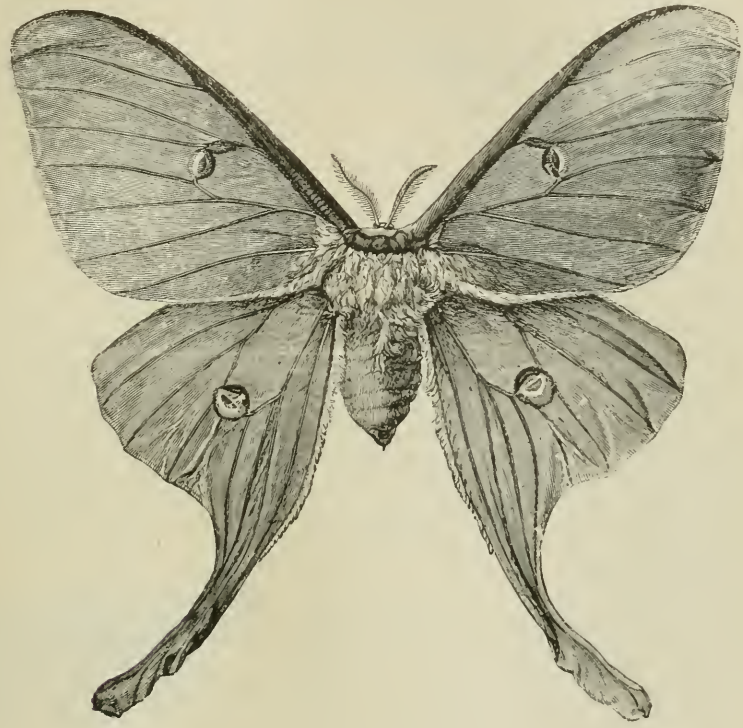

Fig. 20.

The abdomen was fully extended, green in colour with, comparatively, narrow white bands around it. The front winglets were about three-quarters of an inch in length, the hind ones less, clothed with hair-like scales, slightly tinged with yellow, sufficient to contrast with the pure white of the body covering. The tail was bent round and laid along the outer angle of the hind winglet, as shown by part *b* on Fig. 21, which gives a moderately correct representation of it on an enlarged scale. At five minutes to three a green spot appeared near the base of front winglet, gradually enlarging as the fluid spread between the membranes, and deepening in colour as the quantity increased. At three o'clock the green had reached the eye spot on the front wing, and the maroon colour of the costal band. At 3.10 the wing was one inch and a half long. By this time the fluid was passing rapidly along the costal edge and extending, whilst the outer angle had not yet begun to extend; the result was the apex drawn back, the membrane of the wing bulged and bagged outward. At this time the hind wing had got a green tinge along the outer margin, which was extending. At 3.20 the outer angle of front wing had relaxed somewhat, which allowed the costa to straighten and reduced the bulging. 3.35—the front wing looked to be full length, but not full width. 3.45—hind wing well expanded and green coloured; part *b* on Fig. 21 had moved away slightly from part *a*.

Fig. 21.

At four o'clock the space between *a* and *b* was nearly half an inch, but *b* yet retained its horizontal attitude. At 4.10 the space between them had increased, and the point of part *b* was drooping. 4.45—the tail had greatly extended, hanging crumpled and twisted. At 5.10 the moth opened its wings and walked away when I ceased taking observations. I allowed it to live over night. It was a female, not a first-class specimen. It measures four and a half inches in expanse of wing, and three and a quarter from the base of the antennæ to the end of the tail. It is heavily edged with maroon on the outer angle of front wing, and more lightly on the hind wing and outer curve of the tail. There is a row of brown dots on the veins of front wings, three-eighths of an inch from the coloured edge, which are not seen on any other native specimen in the collection. As it matured the abdomen contracted until the white bands united, and the green disappeared.

OBSERVATIONS ON THE SEASON OF 1895.

By J. Alston Moffat, London, Ont.

Hadena Arctica, Fig. 22, one of the climbing cut worms, the moth of which is seen to some extent every season, and in some seasons quite plentifully, appeared in the early part of June in extraordinary profusion, forcing itself on the attention of the most unobservant, and continued for over four weeks to be a complete nuisance to the community. It was to be seen everywhere; shop windows were rendered unsightly by their presence, dead and alive. They would enter dwellings, hiding away for the day in the folds of curtains and clothing, alarming the owners needlessly about their safety, and making themselves generally obnoxious in a hundred ways. I received inquiries concerning them from various directions, which went to prove conclusively that this state of things existed from the Niagara river on the east to the Detroit river on the west; and from the north shore of Lake Erie to the south shore of Lake Huron. How much further they extended I have not learned.

Fig. 22.

The Genus Argynnis, in some of its species, is to be seen more or less abundantly every season. But 1895 gave them forth in numbers both of species and specimens beyond all that I have ever seen before. During July there were five species on the wing at the same time. *Cybele*, *Aphrodite*, *Atlantis*, *Myrina*, and *Bellona*. Upon large patches of flowering weeds that were attractive to them they congregated in force, and when disturbed, they would rise in such a mass as to obscure the view beyond. It was my first experience with *Atlantis*. On the twenty-seventh of June I was in a locality where Argynnis was flying profusely. *Cybele* and *Aphrodite* were abundant, but there were some that seemed to be different from either, and with which I was not familiar. They were smaller in size and with a noticeable black border on the hind wings, so I captured some for comparison. All the *Atlantis* in the Society's collection are labelled "Montreal," and are quite uniform in size and markings. There were none of those I took that were quite so small, or with so much black in the border. On the first of July I secured more, and found that they varied considerably. Some of them I could not say whether they were small *Cybele* or large *Atlantis*, so to settle the doubt, I sent an example to Mr. W. H. Edwards, who promptly informed me that it was *Atlantis*. I saw them plentiful at Sarnia, and Mr. W. E. Macpherson, of Prescott, Ont., said it was the same at Windsor. On the sixth of August I received several specimens from Mr. Macpherson, taken by him at Prescott. They were much nearer to the Quebec type than the majority of those I took here; with a little additional black in the border of the hind wings, they might not be separable. I may state here as a matter of some interest that I never took at Hamilton what I consider to be typical *Aphrodite*, with the dark cinnamon-brown shade on the under surface of the hind wings, which is comparatively common about London, and easily obtained.

On the twelfth of August I had a call from Mr. Wm. Lochhead, of Napanee, Ont., on his way east from a visit to Windsor. When we were looking at a drawer of North American specimens that are labelled "Non-Canadian," his eye resting on *Argynnis Idalia*, he remarked: "There is a butterfly that was taken at Windsor." I had long desired to hear of that species being reported Canadian. I expected it to enter our territory in the east, but instead it has come to us in the west. Afterwards I received through the kindness of W. S. Cody, B.A., a Windsor specimen for the Society's native collection.

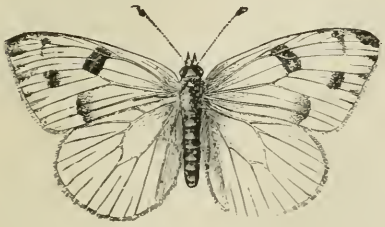

Fig. 23, Male.

Fig. 24, Female.

Pieris protodice has been seen here in greater numbers this season that it was last. It has also been reported to me from other localities. Mr. Macpherson, who spent some weeks collecting about Windsor, Ont., called upon me when he was returning east. Whilst looking over the Society's collection, when we came to the *Pieris* he pointed to the female of *Protodice*, remarking, "There is the butterfly I saw at Windsor and didn't know what it was!" An interesting testimony to its total absence of late years, which seems so strange to those to whom it was such a familiar object in times gone by. I received a letter from W. S. Cody, B.A., of Windsor, dated July 22nd, in which he said, "*Pieris protodice* appeared for the first time here about the 4th of July, although it might have been here unnoticed before that, and soon became more common than *P. rapæ*. Not being familiar with it, I took nothing but females for a while, and think they must have been more common than the males at first." We can easily understand how male *protodice* might pass unnoticed when flying with *rapæ*, Fig. 25. Mr. Anderson took males only here during July; he did not even see a female. It has also been reported to me as being plentiful at Essex, Alvinston and Woodstock.

Fig. 25.

In 1895 the season for collecting commenced early, but received a check later on. Mr. Anderson reported to me some good finds at electric light before I thought it likely that anything could have been got, light proving more profitable with him than bait throughout the season. The fascinating power of light at night seems to be general over all kinds of insects, and by concentrating it at particular points makes it easy to secure quantities of them, and gives an opportunity of estimating the comparative scarcity or abundance of the various kinds better than any other method. In this way, Mr. Anderson could have taken dozens of some kinds that I thought I was doing well to get two or three of in a season in the ordinary way of collecting. Bait will not attract some, no matter how skilfully it is compounded, and it fails with all at times; but light, especially electric light, never fails to draw, if the weather is at all propitious.

In September, I sent to Prof. J. B. Smith a box containing twenty-nine specimens of Mr. Anderson's securing, which I could not identify with anything in the Society's collection. Fourteen of these proved not to be represented therein. I had sent a few Bombycids which the Professor did not care to pronounce upon in the present transitionary

state of the nomenclature. There were some duplicates, different looking forms of one species, whilst others were varieties or better and more distinctly marked specimens of those already named in the collection. As a testimony to the character of Mr. Anderson's work, I quote from Prof. Smith's letter to me accompanying the list of names: "Your box of insects came duly to hand by express, and in good condition. It is by all odds the most interesting box you ever sent me, and contains the best species, as well as, I think, the best specimens I have ever had from you. * * * Your Nos. 2 and 5 (*Copipanolis cubilis*, Grote) are varieties of one thing, and, if you have others, I would very much like to have a specimen, since the species is not represented in my cabinet. No. 3 (*Feralia major*, Smith) is a very good species, recorded, I believe, for the first time from Canada in this sending. Your No. 11 (*Dicopis Grotei*, Morr,) is a beauty, and perhaps the handsomest specimen of the species that I have ever seen. No. 10 (*Xylomiges dolosa*, Grote) is by no means common. The other species need no special reference and are noticeable only by their excellent condition."

Amongst the Bombycids that I sent to Prof. Smith was a Gastropacha, which he gave as "*Ferruginea*, probably." This I expected would likely be so, as it corresponded well with the original description in everything except size. Packard says, Pro. Ent. Soc. Phil. Vol. III., p. 386, "A smaller species than *G. Americana*." But all the specimens that I have seen of this form are decidedly larger. In the "Preliminary Revision of the Bombyces of America North of Mexico," by Neumœgen and Dyar, *Ferruginea* is given as a variety of *Americana*. During the early part of May, *Americana* was abundant at light. This *Ferruginea* did not appear until the middle of June, and not so numerously, and the one had passed before the other appeared, which seems to conflict somewhat with the idea of their being forms of one species.

The other names of this lot that were new to the Society's collection are:

Acronycta hasta, Grote. Resembling *lobeliæ*, but smaller and darker.

Dicopis viridescens, Walk. A widely distributed species.

Mamestra detracta, Walk. The habitat of this species is given in Prof. Smith's List as Labrador, White Mountains, Colorado, 12,000 feet.

Xylophasia lateritia, Hubn. A European as well as American species.

Perigea luxa, Grote.

Scopelosoma devia, Grote. This addition completes the list of this genus in the collection.

Morrisonia evicta, Grote.

Hyblæa puera, Cram. Prof. Smith, in his catalogue, bibliographical and synonymical, gives the habitat of this species as Texas, Florida, West Indies; and remarks, "It seems to be a common form in more tropical regions and only occasional in our own fauna."

Melipotis jucunda, Hubn. This is but the second species of the genus to be represented in the Society's collection. *Limbolaris* was frequently taken about Hamilton. I am not aware of this species being reported from Canada before. The other species of this genus are all given as from the south and west.

I afterward sent a box of Bombycids to Mr. Harrison G. Dyar, who kindly determined them for me. Those of them that were new to the Society's collection of Mr. Anderson's captures are:

Lophodonta georgica, H. S.

Schizura leptinoides, Grote.

Ianassa lignicolor, Walk.

Cerura scolopendrina, Bdv. Upon this species Mr. Dyar remarks, "The specimen is of the form *Modesta*, Hud., the band broken as in *Albicoma*, Strecker." These names are varieties of *Scolopendrina*.

Mr. Anderson also secured two specimens of *Dilophonota ello*, Linn, in splendid condition; and a pair of *Protoparce cingulata*, Fab., with the pink ornamentation beautifully bright and fresh.

Fig. 26.

A rare and interesting capture by Mr. Anderson in the early part of October was a specimen of *Pyrgus tessellata*, Scudder, Fig. 26, fresh and in fine condition. It was in company with another, which he did not secure. This attractive butterfly has been reported once before from Ontario, taken by Mr. Lowe, in Essex County, and given under the synonym of *Hesperia oileus*, Humph.-West, June, 1875.

VARIATION, WITH SPECIAL REFERENCE TO INSECTS

By J. Alston Moffat, London, Ont.

"No compound of this earthly ball
Is like another, all in all."—Tennyson.

Variation amongst forms of life is one of the most interesting and evident truths in nature. The causes at work producing it are receiving a marked degree of attention at the present time, but not more than the importance of the subject deserves. No one has given thought and attention to its manifestation amongst living forms without being subjected to difficulty and perplexity by it. It lies right across the path of the investigator of the laws of life, and is the stumbling-block of the systematist. It cannot be ignored or thrown aside, but must be admitted, and a place given to it in every system in nature that is constructed.

The causes of variation in forms of life are many. Some of them are simple, apparent and easily comprehended. Others are obscure and difficult to trace. As a considerable diversity of opinion exists as to the source of its origin in nature, and the present state of our knowledge does not satisfactorily explain all that we see associated with it, therefore, an orderly statement in plain language of what is known on the subject may not prove objectionable to those who have got into perplexity and wish to investigate the subject for themselves.

All nature—that is, everything that comes within the range of physical investigation—is controlled by unchanging law. Each portion of it has a law or laws of its own, which we call the laws of its nature. We do not see these laws; we know of their existence only by observing the uniformity of their manifestations. For instance, given the same materials in the same proportions and in the same conditions, and the same results will follow every time. Change one of these by ever so little, and a different result will certainly be produced. Thus we have the ever-changing manifestations of nature from unchanging laws, through the ever-changing conditions and combinations of the same materials. Life is as completely under the control of law as matter, but it is infinitely more complex and difficult to trace.

Matter has been divided into the organic and inorganic. The inorganic surface of the globe is the foundation on which rest the organic forms thereof, and from which they may be said to have come, as all the materials for their solid structures and sustenance are derived therefrom. The face of this globe has been frequently changed. There was a time when life could not exist upon it. When the conditions became favorable, organisms appeared suitable for the conditions—low in the scale of life, but neither defective nor degraded. That forms of life varied with the varying conditions of the earth's surface, is conclusively demonstrated by the geological record, and that the organisms of the various geological periods were as thoroughly in harmony with the conditions in which they lived as are those of the present. That many of the forms of life in the present are the lineal descendants of some of those of previous geological periods is extremely probable, if not positively certain, but so changed in appearance by altered conditions as not to be now recognizable.

No doubt many forms of life came and went before insects appeared. These are comparatively highly organized forms of life, the higher appearing later in point of time, life keeping pace with its surroundings, and so maintaining harmony. The conditions are not uniform over all the earth's surface at the present time, and we know that the appearance of the life of the various portions of the globe differs in many instances to such an extent that an expert can tell from what part of the world a particular form came by its appearance; and thus we learn that variation in living forms is not a thing of recent origin.

Our knowledge of the extent to which variation may go is largely obtained from man's efforts to change for his own advantage those kinds which he thought were going to prove conducive to his welfare or gratifying to his fancy. But man's methods in bringing it about are not identical with nature's. Although they must be in harmony with the laws of nature for profitable results, yet illustrations taken from one and applied to the other may be very misleading.

Wallace, in his "Island Life," page 55, says: "Few persons consider how largely and universally all animals are varying. We know, however, that in every generation, if we could examine all the individuals of any common species, we should find considerable differences, not only in size and colour, but in the form and proportions of all the parts and organs of the body. In our domesticated animals we know this to be the case, and it is by means of the continual selection of such slight varieties to breed from that all our extremely different domestic breeds have been produced. Think of the difference in every limb and every bone and muscle, and probably in every part, internal and external, of the whole body between a greyhound and a bull-dog! Yet if we had the whole series of ancestors of these two breeds before us, we should probably find that in no one generation was there a greater difference than now occurs in the same breed, or sometimes even the same litter. It is often thought, however, that wild species do not vary sufficiently to bring about any such change as this in the same time; and though naturalists are well aware that this is a mistake, it is only recently that they are able to adduce positive proof of their opinions."

In this extract we get great truths clearly stated, with a misleading inference appended. No divergence has ever appeared in the dog family in nature at all comparable to that between a greyhound and a bull-dog, and I have no hesitation in saying never would, no matter what length of time was given, and so long as the dog remained in a state of nature, we might add never could, and the reason is simple and obvious. All man's domestic animals came originally from wild forms; all the possibilities that man has disclosed were latent therein. Under domestication they became apparent, then by selection, elimination and rejection, man led one strain in this direction and another in that, concentrating and exaggerating these points of difference until the present results have been reached. Now, selection in nature is of the most indiscriminate character possible. There is a constant commingling of the slightly divergent forms going on that never gives any peculiarity an opportunity to concentrate and disclose itself very conspicuously, and if it did in one instance it would be reduced or even obliterated, to all appearance, in the next generation. And it is this sort of selection that produces and maintains that marked degree of general uniformity which we see does prevail amongst living forms in a state of nature. Thus we learn how widely divergent is the result of selection in nature from selection by man for his own benefit, the one tending to reduce variation to a minimum, the other to carry it onward to its maximum.

The most powerful influence for the producing of variation in life in nature, is to be found in external conditions. A power inherent in a locality, capable of modifying the appearance of an organism residing therein, combined with the susceptibility in varying degrees of the organism to receive, retain and transmit the impressions. That living forms are changed in appearance by residence in different parts of the globe is a fact not requiring to be proved in the present day. It has forced itself upon the attention of all observing travellers, and the books of such travellers as Darwin and Wallace are full of examples of it; and as the attention of those engaged in the investigation of nature is

being more than ever turned in this direction, illustrations confirmatory of it are being multiplied. In his later writings, Darwin acknowledged that he might not have assigned to it all the importance that it deserves, or the consideration to which it is entitled, and as investigation progresses, its influence in producing variation in nature is becoming more generally admitted. In tropical countries, where life is under a kind of forcing process, this power is strikingly exemplified in insects. There we find variation showing itself in the changed appearance of the same kinds of insects, within shorter distances and in greater numbers. Wallace tells us of one form of butterfly that he traced from the seashore inland until it was scarcely recognizable as the same species, so greatly did it change. This is an exceptional case, but the influence is present, if only the organism is sensitive enough to take the impression. Then consider, that a similar influence is at work to some extent, in some direction, on every form of insect life in the world, and we may form some conception of the tremendous power at work producing variation; for it is a fact well established by observation of life in domestication, that when a change has been brought about in an organism, it is easier afterwards to produce more and greater. But more; the same laws that are in operation at present, producing such results, have been at work ever since insects had an existence. Through all the various geological periods in which they have lived, this moulding and modifying influence has been going on, so it is not very surprising that the liability to vary should be so well established in their constitution now.

Because such a power exists in nature, we have no authority for supposing that it may go on indefinitely, and produce not only different looking things of the same kinds, but also different kinds. That would be contrary to the laws of nature as we know them, also to observation and experience. Each sphere of influence is well defined, whether we can trace it or not. It has a centre where it will be most powerful, and a circumference where it may be more weak, but if a change is to be brought about in the organism, a change must be made in its habitat, or it must be made to change its habitat. What difference would be produced by the change would have to be discovered by observation, if the organism survived it, for it is well known that conditions not necessarily fatal to life in themselves, might become so if brought about suddenly. Organisms do not change themselves by an effort of the will; this influence is external to themselves, and modifies them quite unconsciously to themselves.

What these influences are, or how they operate in producing a change in organisms, is at present but little known. Past observations point to chemical agency as a powerful factor. Indeed, in one view of it, the surface of the sphere on which we live is one huge chemical laboratory. The process of disintegrating matter and re-compounding it is perpetually going on. Then the various organisms are composed of multitudes of cells that are endowed with the power of choosing and absorbing from inorganic substances the materials required for their own special wants, and passing them on to other cells to be transmuted into the proper ingredients for the producing and sustaining of every organ in each and all, even the most complicated and highly organized beings on the earth. In the case of insects, heat and cold, moisture or its absence, light and obscurity have been shown to have an influence in changing their size and colour, the result, no doubt, of chemical combinations and actions. We see frequent instances of the same conditions producing opposite effects in different organisms, attributable to the inherent power of cells for differently combining the same materials or transmuting them chemically. And now that the conclusion has at length been reached, confirmed by correct scientific investigation, and one which harmonizes so well with all our observations and experiences, that heat does not come to us through space, but is chemically produced within our atmosphere in some way by means of the sun's rays, which are electrical, we seem to have got in some measure an explanation of how geologic and climatic influences obtain their power to modify organisms.

Although external influences are the most powerful originating cause of variation in living forms in nature, the most obvious one, and the one that attracts the most attention, is brought about by the intermingling of existing varieties, which tends to produce yet more abundant variation. The parents being unlike, we see some of the offspring

taking after one parent, some after the other, some with a curious admixture of both; whilst others have no special resemblance to either. One does not require to travel in order to obtain abundant evidence of this.

In following out this part of my subject, I shall have occasion frequently to use the term *species*, so it will be well first to define the sense in which I use it. I remark, then, that I accept without reservation Worcester's definition of the term, which he states thus:

"1. Appearance to the senses or the mind; sensible or intellectual representation.

2. An assemblage of individuals allied by common characters, and subordinate to a genus or sub-genus; a group.

☞ In zoology and botany *species* is founded on identity of form and structure, both external and internal. The principal characteristic of *species*, in animals and vegetables, is the power to produce beings like themselves, who are also productive."

Here we have the term as used in connection with non-living matter used in classification, and as specially applied to living matter. In non-living matter, such as soils, rocks and inorganic substances generally, *species* are separated by appearances as they present themselves to the eye or mind. They are tested by the senses, when found to be different, they are pronounced to be specifically distinct. There are no differences of opinion as to their right to be called *species*; and the reason of it is, that they are inert and passive under external conditions. Specimens of the same species may be separated by thousands of miles, and that for thousands of years and no perceptible change has taken place in them. But living matter is constantly changing; from less to greater; from young to old; from vigour to decay; from one generation to another, all passing on to death and dissolution. What a gulf separates these two kinds of matter! or, if you will, the same matter under such different conditions. Now it is not in harmony with what is considered to be exact scientific phraseology, to apply the same term in the same way to two such differently constituted subjects of investigation; and separate *species* in living forms on exactly the same lines as in non-living matter. Taking "appearance to the senses" as the only guide to a definite conclusion; and yet that is what has been, and is yet being done by numbers of systematists and the result is, confusion and uncertainty.

Take as an illustration of how this method works in practice, the oft-quoted instance given in Darwin's "Origin of Species," p. 37. "Mr. Balington gives two hundred and fifty-one species to a given genus. Whereas Mr. Bentham gives only one hundred and twelve. A difference of one hundred and thirty-nine doubtful forms." Both are supposed to be competent authorities, why this vast difference in the result of an investigation of the same material? The answer to the question is to be found in the method of conducting it. Mr. Balington probably had a keen eye for detecting things that differ. He surveyed his material and separated it according to appearances, and when he was done he found that he had two hundred and fifty-one forms in which perceptible differences presented themselves to his mind, and he called them *species*.

Mr. Bentham was probably more critical. He might take into account the fact that living forms were always liable to vary more or less, and he would see that some of these forms so imperceptibly merged into one another, that he suspected that they were not entitled to be called *species*, so he united some here, and some there along the line, making their differences more perceptible whilst he reduced their numbers to one hundred and twelve, according to his estimate of what constituted a *species*.

Now that is exactly what might happen with any two investigators of a genus, with numerous so-called species upon this continent, who separated their *species* by perceptible differences. And that is probably what did occur in the genus that originated the "Colias Controversy," or the one that has started the Argynnis contention. Darwin himself worked on the same lines, and he has told in his own vigorous language what trouble he got into through it. He says: "After describing a set of forms as "distinct species, tearing up my manuscript and making them one "species, tearing that up and making them separate, and then "making them one again—as has often occurred to me—I have "gnashed my teeth, cursed species, and asked what sin I had committed to be so

punished?" and such is the natural result of an effort to attain to certainty, by means of an uncertain method; and no amount of investigation upon the same lines, by ever so competent an authority, can ever be unmistakably certain. The only conclusive verdict must be obtained by an appeal to nature; unite the differing forms, and if they have "the power to produce beings like themselves who are also productive," then the species is one, and the different forms are portions of it This is the law of nature controlling all bi-sexual life, and it is extremely doubtful if there has ever been a well authenticated instance of its violation. Cases have been reported of so-called different species having been united, and the product carried forward for several generations, but that simply proves that the term *species* had been wrongly applied; and this wrong application of the term by namers and describers of species is traceable to the method of making species exclusively from perceptible differences. To illustrate the danger to which such are exposed in following that method, I quote the following passage from Wallace's Island Life pp. 55 and 56. "An American naturalist, Mr. J. A. Allen, has made elaborate observations and measurements of the birds of the United States, and he finds a wonderful and altogether unsuspected amount of variation between individuals of the same species. They differ in the general tint, and in the markings and distribution of the colours; in size and proportions; in the length of the wings, tail, bill and feet; in the length of particular feathers, altering the shape of the wing or tail; in the length of the tarsi and of the separate toes; and in the length, width, thickness and curvature of the bill. These variations are very considerable, often reaching to one-sixth or one-seventh of the average dimensions and sometimes more."

We see in this extract, the perplexity that must necessarily arise in the mind of those engaged in studying such variable forms from their point of view, as to how far this sort of thing may go before it becomes a different species. Now, man has demonstrated most conclusively in connection with his domestic animals, that no amount of that kind of variation interferes in the slightest with the various forms uniting, "and producing beings like themselves, who are also productive" And the same laws are operating upon life in nature in the same way. *Species*, is a question of lineage; not of size, form or colours. These are incidental.

Having given the manner in which I use the term *species*, I continue the subject of variation.

We have seen that there are a combination of influences at work in every habitable portion of the globe, producing a change in the appearance of the life of each, in proportion to the susceptibility of the species to receive the impression. That such spheres of influence have a centre and a circumference, well defined although to us unperceived, except by the effect produced. Long residence in a locality for many generations giving the influence of that locality an opportunity to exert its utmost on the species living under it, whilst propagations with the local stock will tend to produce a more distinctive form of a species, acting as in-and-in breeding does in domestication. A fact well illustrated by the life of Islands, which is as a rule more uniform in appearance than that of continents with their extended areas.

Now it is an acknowledged fact that insects are notorious for spreading; either from their innate desire to migrate, or by external assistance. So the particular forms of one locality are constantly getting mixed with the different forms of the same species in another locality; uniting with them, "and producing beings like themselves who are also productive." It is a well-known experience of breeders in domestication, that when differing strains of the same species are united, a great uncertainty exists as to what the appearance of the offspring will be; and the greater the difference is, the uncertainty becomes proportionately greater. But more, we have to take into consideration not only the late ancestors which we may have seen, but remote ancestry which we could not see, that may have had in them strains that we never suspected, until they showed themselves in those we see.

Now this commingling of different forms of the same species is constantly going on all over the habitable globe, and given time and opportunity a species, or its descendants, could encircle the earth and produce confusion amongst the typical forms of every locality.

And when we consider that the forms of each locality are thus pushing their way outward, to mingle with those of other localities, we have an abundant source of supply for unlimited variations from the well marked and easily defined forms of any species, to the most minute shades of differences that are well calculated to drive the makers of "Species by perceptible differences" to the verge of distraction.

Let us now throw the reins to imagination, and urge it on to its utmost capacity, for it can never exceed the truth in this direction, and conceive if you can the multiplied diversity of external influences that insects have been subjected to since they were first originated up to the present time. Think of the differences of the environments they may have lived in for a greater or less extended period, and that each and all were perfectly adapted to their times and conditions, harmonizing with and fitting into them as naturally and unconsciously as water fits into a vessel. That the surface of the globe has always been diversified in climate; that insects were as susceptible to external influences, as much given to migrating and mingling together the diverse forms of the same species, and thus multiplying diversity as now; and that this and a great deal more has gone on through all the geological eras and ages that have intervened between their first appearance and the present, there seems but little cause left for wonder that *species* should be difficult to define by perceptible differences. But lest the surprise should take the opposite direction, and the wonder be that classification is possible, remember that this has all gone on under the control of unchanging laws—the laws of life and heredity, with their marvellous power of colour and form, producing beauty and attractiveness; the laws of matter and force, those that make for change and those that tend to stability; chemical affinities and combinations; brought about through light, cold, heat, and electricity; change without haste, yet without cessation; almost imperceptible, but unmistakably accomplishing results; like some huge, complicated, perfectly adjusted, self regulating machine, so absolutely perfect in its operations that it has never needed alteration or repair since it was first set in motion. Or as the fabled mills of the gods that ground very slowly but very fine, whilst the outcome of the process is what we see. Here we have "descent with modification" throughout the ages, but the same species still, if in the direct line of descent.

In such plain and evident facts of nature we seem to get sufficiently powerful and persistent causes to bring about the superabundant diversity that characterizes insect life without entering upon those that are obscure and doubtful.

The period of existence when insects are most susceptible to external influences are in the egg, larval and pupal stages. It is in these that the impressions are received which afterwards show themselves in the changed appearance of the imago. When a change has been produced in the appearance of the mature insect, a change may reasonably be expected in its early stages. Therefore when different localities are possessed of influences that are capable of making themselves manifest in the different appearance of their mature forms, and the early stages of these forms partake of a corresponding difference, and they breed true to their particular forms through all their stages, it proves nothing whatever as to their specific standing. This for conclusive settlement will require the extremes of the mature forms to be brought together, united, and see if they will produce beings like themselves, who are also productive. If so, then the species is one, regardless of their differences.

My subject would seem naturally to end here, but there are views held by some that are not in harmony with those stated, which will suggest objections that can be anticipated and may be replied to here without departing from its general scope and purpose.

Some will be ready to say, if the species is one the name should be one also. I reply, that a single description can never cover a multiform species. A constantly recurring form that requires a separate description to make it recognizable, should have a separate name. This might have the effect of reducing the number of species and increasing the number of names. Mr. W. H. Edwards has somewhere said (I quote from memory and may not be exact): "We have no such a butterfly as *Ajax*. We have *Walshii*, *Abbotii*, *Telamonides* and *Marcellus*. These four forms constitute *Ajax*." Here it requires four descriptions and four names to correctly distinguish one species. Mr. Edwards applies

that principle throughout his check list to all seasonally polymorphic butterflies. Let the same principle be followed in dealing with all sorts of variations, amongst all kinds of insects, and worked out in their classification, so far as is known, and what an amount of exact information could be conveyed at a glance as to the relationship of the different parts of any multiform species. We would have the different forms that are to be found in separated localities in the same country distinguished by name, and the forms of the same species found in other countries, continents or islands, with distinguishing names, whilst their habitat might be indicated as well. We should have also the kind of varieties, whether permanent local forms or incidental variations on these, brought about by the intermingling of separate forms, varieties wholly the result of natural operations, or produced by man's interference with the course of nature in pursuit of his own ends, and thus including the most recent variations; giving an opportunity to indicate forms that may have been exterminated through altered conditions, varieties seasonal, sexual or unaccountable, thus giving a world-wide view of every variable species according to the extent of knowledge procurable up to date, laying a solid and certain foundation for future advances in the same direction. It would be an immense convenience if *species* could be defined by appearance with certainty, but past experience has, so far, proved it hopeless. An approximation to the facts is the most that can be looked for. Ova, larvæ, and pupæ can all be classified by appearances as well as imagoes, but a system reared upon preparatory stages would fail of certainty as sure as on the mature one. No regularly graduated line can be formed of either, some inconvenient breaks are found in all. Some forms are found that will not fit in comfortably anywhere, whilst affinities are found in others that point in opposite directions. Yet for final arrangement and classification surely it is upon the affinities and resemblances of the mature form it ought to be founded, all the others being but preparatory thereto. So I conclude that the limit of *species* is found by uniting two, when the beings produced are uniformly non-productive, but the limit of variation cannot be reached until the power to produce different conditions and combinations has been exhausted.

SOME WINTER INSECTS FROM SWAMP MOSS.

By W. Hague Harrington, F.R.S.C., Ottawa.

Where are the insects in winter? What becomes of all the varied winged and painted forms that in the hot summer hours fill the air with movement and sound? Then every nook and corner of the land has its tiny familiar folk, flitting from flower to flower, in restless haste; every plant has its devouring hosts, and crawling, running, leaping creatures swarm in every direction. With the shortening days and the approach of frost, the myriads of insects, which have added so much to the joyous, exuberant life of summer, fast disappear and silence broods through forest glades and over meadow vales, which rang continuously with the shrill murmurings and stridulations of the innumerable orchestra. A few drowsy flies crawling on a sunny surface, or an occasional butterfly flitting in the midday warmth, may occur until winter has well set in, but these at last disappear. The winds strip off the dead foliage, the frost congeals the surface of the ground, and snow covers, beneath its chill pure shroud, a land from which all life seems to have departed. "All the insects are dead" the thoughtless remark, forgetting for the moment that they will be as numerous and lively in the forthcoming summer, and that none of the immense variety of forms will be created afresh.

Certainly the vast majority of the individuals, which are seen during the warmer season, perish before the close of the season, for the life of most insects is but a brief span, but the perpetuity of the species is preserved in spite of the apparent death of all the individuals. In some secure hiding places, then, the representatives of each species must remain during the long months of frost and snow. Those who have not made a study of our smaller forms of life would find it difficult to search out any of the swarms which are waiting for the vivifying breath of spring. Some might remember that our houseflies have crawled away into cracks and crevices, from which to sluggishly emerge

when it becomes warmer, but probably this would be the measure of their knowledge of the winter life of our insects. The entomologist, (concise term for the student of insect life,) however, who seeks to make himself acquainted with the complete life-history of each species, has as an essential part of his task to discover how the winter is passed. Naturally he finds that there is much diversity of habit, and that it may be either as egg, larva, pupa or imago, (adult or fully developed form) that the long cold months are safely tided over and the unbroken succession of the species preserved.

Many of our forms find security in the bottoms of the streams and pools, protected by the shield of ice which has been formed above them. Others are safely buried in the ground, beyond the reach of frost, or hidden in their burrows in our forest trees, but a great proportion are incapable of attaining such a degree of protection, and have to be content to hide in some crevice or similar shelter, or to depend upon such covering as they may be able to construct. It might well be supposed that those non-aquatic insects which hibernate in the perfect state would seek out some nice dry cranny in which, if possible, to shelter themselves from both cold and wet. Surprise may therefore reasonably be excited when it is discovered that a considerable degree of moisture seems in no degree harmful even to many species of a most delicate and fragile organization. The saturated frozen mosses of the swamps might appear the very opposite of suitable winter-quarters, and yet they very frequently contain an amazing number and variety of insects.

Having at several times gathered quantities of such mosses in the early winter, and obtained from them many interesting specimens, it has occurred to me that a brief summary of the result of my last foray of this sort might be of some interest to those who are curious as to the winter existence of our insects. I hope, too, that the list which I shall furnish may be of some little value to our many students in this branch of natural history, and may perhaps give some new light as to the habits of some of the species. For in all of our investigations we must bear in mind that, without a complete knowledge of the full yearly round of the existence of each species, we may perhaps lack just what it is most essential to know.

At the present time great attention is given to what is called economic entomology, which merely means the application to the benefit of the community at large of the knowledge which is slowly and laboriously gathered by many students, working generally merely for their own love of investigation, and often at considerable expense and self-sacrifice. At the Central Experimental Farm, at Ottawa, Canada has employed a very capable and indefatigable entomologist whose investigations and reports cannot but convey much needed information to the agricultural population. But the capacity of any man to make investigations is limited by the time at his command, and he is therefore compelled to avail himself of the labours of others, and as there is no one, especially if resident in the country and engaged in agricultural pursuits, who has not opportunity for observing the habits of some of our insects, there should be many who could render some aid to our excellent Government Entomologist, Mr. Fletcher, by communicating to him the observations that have been made. In devising methods for the destroyal and control of those insects which are classed as injurious (either to plant or animal life) it may become important to ascertain how they survive the winter, so as to know at what season they may be most easily and cheaply combatted.

Before proceeding with my list of species I will summarize for my non-entomological readers the method employed in collecting the specimens. The best localities for gathering the moss are to be found in swamps, surrounded and interspersed with trees and shrubs, and offering to the botanist in summer a considerable variety of plants. The ordinary sphagnum moss which may be found in some places is too wet to contain many insects, but the mosses which occur in abundance in somewhat drier localities will generally well repay investigation. It is profitable also to collect those which grow around the roots of trees, upon fallen logs, and upon the little knolls and hummocks of the swamps. The mosses, of course, will be mixed, more or less, with grasses, fallen twigs and leaves and various foreign matters, but the presence of these is not a source of any inconvenience in examining the material collected. A sackful gathered in the nearest swamp will furnish interesting occupation for many subsequent hours, and its contents

can be examined as opportunity offers. A damp, cool cellar is the best place to keep it until such opportunities occur. For the examination of the moss, take a shallow box, several inches square and about three deep, and replace the bottom by fine wire netting of about eight holes to the linear inch. Placing this box upon a sheet of white paper, a handful of moss is torn to pieces in it, and the insects which may be present will fall through the netting. Before emptying the debris out of the box give the latter a sharp tap to dislodge any that may be "playing possum" or clinging to the wire. The insects which are now seen scampering off at different rates of speed may be picked up with a fine forceps or the moistened tip of a camel's hair pencil, and dropped in a small phial of alcohol or a cyanide bottle. It is well, if possible, to do this work in an uncarpeted room, or one in which a few spiders and other forms which will surely escape, may not create any disturbance. Spiders especially display great alacrity in making themselves scarce, and there are many beetles that are most agile in their movements, and even if picked up in the forceps will wriggle out and dart off in a new direction, always aiming, however, for the farthest edge of the table.

By adding the species collected in previous years my lists could be lengthened but I intend to confine them to the results obtained from the gathering of one season. The material examined consisted of about a peck collected on 17th Nov., about the margins of a little swampy inlet below the aboretum of the Experimental Farm, and the contents of an ordinary grain-sack filled, six days later, in Dow's swamp, (a regular cedar and tamarac marsh) upon the opposite side of the canal. At the latter date the surface of the ground was frozen and some snow had fallen, so that the moss was partially frozen and mixed with snow, making the bag pretty heavy for portaging, and I remember that, when I boarded an electric car with my burden, it provoked general curiosity (which remained unsatisfied) on the part of my fellow passengers. I have separate records of the insects from each place, but as the dates and localities were so near together I shall give but one list of the coleoptera, hemiptera and hymenoptera with the joint number of individuals of each species, to show their relative abundance.

The total number of species enumerated is 147 ; of which 52 occurred in both localities, 59 in Dow's swamp only and 36 at the Experimental Farm only. The number of individuals mounted and examined was 1,345, of which 889 were from the swamp and 456 from the Farm. These figures do not represent all the insects yielded by the moss, for of several of the commoner species no attempt was made to save all the examples, while some individuals escaped in spite of all attempts to capture them. In addition there were numerous individuals belonging to some of the other orders of insects, such as flies, thrips, and spring-tails, of which there were several varieties always leaping around. There were also many allied forms, such as mites, spiders, chelifers and myriapods. Among the many larvæ of various kinds may be noticed especially one which was not infrequent, and which afforded apparently a striking instance of protective mimicry. This was the larva of some fly, in which the segments of the body were so shaped and ornamented as to give the creature, which was of a bright green colour, an exact resemblance to a fragment of the moss.

The several varieties of moss contained in this gathering formed in themselves an interesting subject for examination, and in addition to the various forms of life already noted there were many examples of several of our smaller molluscs. Of these there were probably more than a dozen species, and they were preserved and handed over to one of my conchological friends to add to his collections and records. The examination of the moss was not concluded for several weeks, and it was found that its occupants remained alive and active so long as it was not allowed to become too dry, or was not exposed to excessive cold. Many of the insects proved most interesting and several had not previously been found by me. I regret that about one-third of the species have not yet been satisfactorily named, which indicates that the knowledge of our insects is yet very imperfect, and that more students are needed in the entomological field.

Coleoptera.

Carabidæ.

Bembidium variegatum *Say* 2
sulcatum *Lec*..... 6
Pterostichus femoralis *Kirby*..... 12
Platynus picipennis *Kirby* 2
Lachnocrepis parallelus *Say* 1
Oodes fluvialis *Lec* 1
Tachycellus nigrinus *Dej*..... 3

Dytiscidæ.

Ilybius ignarus *Lec* ?..... 1
Ilybiosoma bifarius *Kirby* 1
Agabus sp..... 1

Hydrophilidæ.

Hydrochus subcupreus *Rand*..... 3
Hydræna pennsylvanica *Kies*..... 6
Philhydrus perplexus *Lec* 2
sp 2
Hydrocombus lacustris *Lec*..... 8
Hydrobius feminalis *Lec* 8
fuscipes *Linn* 1
subcupreus *Say*..... 6
Cercyon sp..... 2
Cryptopleurum vagans *Lec*..... 14

Silphidæ.

Colon sp..... 4
sp..... 1
Clambus puberulus *Lec* 1

Scydmænidæ.

Scydmænus fossiger *Lec*..... 40
sp. (small)..... 27

Pselaphidæ.

Ctenistes piceus *Lec*..... 6
Pselaphus erichsonii *Lec* 15
Tychus longipalpus *Lec*..... 1
Decarthron abnorme *Lec*..... 3
Ratrisus globosus *Lec*..... 1
Bryaxis conjuncta *Lec*..... 68
rubicunda *Aubé*..... 9
propinqua *Lec*..... 128
Trimium sp..... 1

Staphylinidæ.

Falagria bilobata *Say*..... 6
dissecta *Er.* ?..... 1
Aleochara nitida *Grav*..... 4
sp..... 1
? sp..... 1
Dinopsis americanus *Kraatz*..... 1
Acylophorus pratensis *Lec*..... 2
Philonthus lomatus *Erich*..... 4
nigritulus *Grav*..... 7
decipiens *Horn* 2
Diochus schaumii *Kraatz* 16
Stenus femoratus *Say* ?..... 28
erythropus *Melsh*..... 2
pusio *Casey* 4
caniculatus *Gyll*..... 9
croceatus *Casey*..... 2
Euæsthetus americanus *Er* 3
Lathrobium punctulatum *Lec*..... 1
bicolor *Lec*..... 1
concolor *Lec*..... 2
simplex *Lec*..... 2
sp..... 1
Stilicus dentatus *Say*..... 6
Lithocharis sp 8
Sunius binotatus *Say* 1
brevipennis *Aust*..... 2
Tachyporus jocosus *Say*..... 1

Staphylinidæ—*Continued.*

Tachyporus brunneus *Fab* 12
Conosoma sp..... 2
Boletobius sp..... 1
Mycetoporus americanus *Er* 5
Olisthærus substriatus *Gyll*..... 1
? sp..... 1
? sp..... 44
? sp..... 14
? sp..... 5

Trichopterygidæ.

Trichopteryx sp..... 116
sp 6

Scaphidiidæ.

Scaphisoma convexum *Say* ?..... 2

Corylophidæ.

Artholips marginicollis *Lec*..... 23

Coccinellidæ.

Hippodamia 13-punctata *Linn*..... 1

Cucujidæ.

Læmophlæus convexulus *Lec*..... 1

Cryptophagidæ.

Atomaria ephippiata *Zimm* 45
sp. (brown)..... 38
sp. (black)..... 1
sp. (small red)..... 24
? sp..... 3

Nitidulidæ.

Omosita colon *Linn*..... 2
Ips fasciatus *Oliv*..... 4

Latridiidæ.

Stephostethus liratus *Lec* 1
Corticaria pumila *Lec* 53
cavicollis *Mann*..... 3

Byrrhidæ.

Cytilus sericeus *Fab*..... 2

Dascyllidæ.

Cyphon variabilis *Thunb*..... 3

Throscidæ.

Throscus alienus *Bonv*..... 1

Buprestidæ.

Taphrocerus gracilis *Say*..... 1

Chrysomelidæ.

Donacia Kirbyi *Lac*..... 1
Chætocnema subcylindrica *Lec* 5
Odontota nervosa *Pang*..... 2

Otiorhynchidæ.

Otiorhynchus ovatus *Linn*..... 2

Curculionidæ.

Apion sp..... 1
Phytonomus nigrirostris *Fab*..... 35
Listronotus sp 1
Macrops sp 3
Tanysphyrus lemnæ *Fab*..... 1
Acalyptus carpini *Hbst* 1
Pelenomus squamosus *Lec* 2
Cœliodes nebulosus *Lec*..... 1
? sp..... 2

Notes on the Coleoptera.

Two-thirds of all the species belonged to the Coleoptera, or insects in which the hind pair of wings, when present, are the organs of flight, and are protected by the thickened front pair, known as elytra. A large proportion of our beetles are ground-dwellers, roving about through the herbage and moss, or hiding under stones and rubbish, and these are best represented. Many of these are predaceous; the remainder feeding chiefly upon decaying animal or vegetable matter, and comparatively few attacking living plants. In the above list twenty-two families are represented by 103 species, of which forty occurred in both gatherings, while twenty-seven were peculiar to the Farm and thirty six to the swamp. The former locality furnished 383 individuals and the latter 594, so that, with the beetles that escaped or were not preserved, there were considerably over 1,000 examples in these mosses, which certainly shows that they were pretty thickly distributed throughout the swamps.

Of the seven species of Carabidæ, *Oodes fluvialis* was a new record for Ottawa, while *Lachnocrepis parallelus* is also an uncommon species here These beetles were found under the thick covering of a prostrate log, and were in shallow cells in the earthy matter on which the moss grew, evidently prepared to abide the winter there, as is done by other members of this family. The Dytiscidæ and Hydrophilidæ are aquatic or subaquatic beetles, although many of the smaller species live largely in decaying vegetable matter. The Pselaphidæ, a family well represented both in species and individuals, contains very small forms, which are stated to feed upon animal substances, and probably subsist in part upon other small inhabitants of the moss. *Bryaxis propinqua* and *B. conjuncta* are remarkably abundant, especially in Dow's swamp. Nearly one-third of all the species of Coleoptera belong to the Staphylinidæ, a very extensive family which I have not found time properly to study and of which there are many unnamed species in my cabinets, even of the commoner forms. These beetles are slender, depressed, elongated insects, with short elytra, remarkably quick and erratic in their movements, and living chiefly on decomposing animal or vegetable matter. The genus Aleochara contains, however, true parasitic species.

Of all our beetles the smallest species are those that belong to the family with the very long name, Trichopterygidæ, which signifies that they have wings fringed with hairs. One species was present in great numbers, and although mere black specks on the white paper the beetles are very nimble and run swiftly about. The members of the Cryptophagidæ and Lathridiidæ are also very small, and subsist upon fungi and decaying vegetation. One of the most interesting beetles of the list is the pretty little *Taphrocerus gracilis*, the only buprestid I have ever found hibernating. This species is taken with the sweeping net in low meadows in June and I believe the larva feeds in the stems of the sedges or large grasses. All the rest of the beetles are plant-feeding, and the most abundant species, *Phytonomus nigrirostris*, is known as a clover-pest.

Hemiptera.

Corimalæna pulicaria *Germ*	5	Coriscus inscriptus *Kirby*	1
Neotiglossa undata *Say*	1	Salda sp. undescribed	1
Cymus angustatus *Stal*	5	Ulopa canadensis *VanDuzee*	62
Salicia pilosula *Stal*	3	Acocephalus mixtus *Say?*	6*
Scoloposteth us affinis *Schill*	2	Helochara communis *Fitch*	4*
Lygus flavonotatus *Prov*	2	Philaenus sp.	1
Corythuca arquata *Say*	7	Livia vernalis *Fitch*	1
? sp.	17*		

Notes on the Hemiptera.

The species of Hemiptera include ten belonging to the division Heteroptera and five to the Homoptera. They were more abundant in the drier mosses. Seven species were common to both localities and four peculiar to each. The total number of individuals was 118, of which more than half belonged to the curious short-winged species which Mr.

VanDuzee has named *Ulopa canadensis* and which has been noted previously as occurring in Ottawa. Mr. Kilman has also found the species at Ridgeway, and it is probably widely distributed. The specimens marked with an asterisk were nymphs, or immature forms, so that the species could not be exactly determined. The insects belonging to this order are the only forms properly entitled to the name "bug," and they are mainly plant-feeding. Subsisting upon the juices, which they suck from the leaves and stems by means of the tubular beak formed by the prolongation of the mouth-parts, they rank among the insects most injurious to plant life, and are most difficult to destroy or keep in check. The smaller forms, known as plant-lice, are very numerous in species, and they multiply with great rapidity, so that a very brief time suffices for the attacked plant to become quite covered by the immense number in all stages of growth, and to have its vitality exhausted.

Hymenoptera.

Proctotrypidæ.	
Megaspilus ottawaensis *Ashm*	5
Ceraphron minutus *Ashm*	4
flaviscapus *Ashm*	2
carinatus *Ashm.* ?	5
mellipes *Ashm.* ?	2
Aphanogmus bicolor *Ashm*	8
Telenomus sp	1
Acoloides subapterus *Ashm*	4
seminiger *Ashm*	1
sp. nov. ?	1
Bæus minutus *Ashm*	47
Prosacantha melanopus *Ashm*	1
Hoplogryon brachypterus *Ashm*	41
sp. nov. ?	1
Gryon canadensis *Ashm*	68
borealis *Ashm*	3
Paramesius clavipes *Ashm*	2
Diapria sp	1
Trichopria carolinensis *Ashm*	4
Trichopria sp. (apterous)	2
sp	1
Phænopria aptera *Ashm*	16
* hæmatobiæ *Ashm*	10
Mymaridæ.	
Cosmocoma sp	2
Formicidæ.	
Camponotus marginatus *Latr*	1
Lasius brunneus *Latr*	1
Tapinoma erraticum *Nyl*	1
Myrmicidæ.	
Myrmica lobicornis *Nyl*	14
sp	1

Notes on the Hymenoptera.

That this order should be so well represented will probably be a matter of much more surprise than the occurrence of a large number of the ground-frequenting beetles. One is apt to think of its members, in their adult form at least, as delicate-winged forms flitting about in the sunshine. But besides the ants there are many wingless or sub-wingless forms belonging to the various parasitic groups. Nearly half of the species in the above list belong to these non-flying hymenoptera, but the remainder have fully developed wings. It will be seen that twenty-nine species are enumerated, of which five occurred in both localities, five at the Farm only (of which four were ants) and nineteen only in the swamp, which was decidedly the most prolific ground, yielding 218 out of the 250 specimens collected. Many more ants could have been collected, for their nests, some of considerable size, were scattered all through the swamp, but those secured were stragglers that had probably got lost in their wanderings, and had not been able to reach home before the cold weather stopped their journeyings. With the exception of these ants all the species are very minute, and belong to the family Proctotrypidæ; except one species belonging to the Mymaridæ, a small group formerly included in the Proctotrypidæ but which Mr. Ashmead considers should constitute a separate family. The first six species belong to the sub-family Ceraphroninæ, whose members are parasitic on Aphididæ (plant lice) and Cecidomyiidæ (midge-like flies forming gall-like swellings, etc.). The following ten species belong to the sub-family Scelioninæ, all of which are egg parasites, the larvæ living in the eggs of other insects. I have bred as many as thirty-one individuals of a species of Telenomus from two eggs of one of our large moths, but usually one parasite occupies each egg. Seven species belong to the sub-family Diapriinæ, parasites of the larvæ of flies. The most abund

ant form was the wingless *Gryon canadensis*, of which all but five specimens were from Dow's swamp. The closely allied, short-winged *Hoplogryon brachypterus* was almost as numerous, three of the specimens being from the Farm. The second in point of numbers was *Bœus minutus*, which occurred only in the mosses from Dow's swamp. Probably some individuals escaped my notice when I was sifting the moss, as it is much the smallest species in the list. It is a very agile atom, and able to leap a considerable distance, while even the least dust upon the paper suffices to hide it, as it is a mere speck itself The whole forty-seven specimens placed head to tail would make a line hardly an inch in length. As the members of this genus are parasitic in the eggs of spiders this minute species will probably infest the eggs of some of our smaller spiders, but I have not yet succeeded in breeding any. The Cosmocoma is a fragile little form with narrow wings, interesting chiefly as being the first mymarid which has been captured by me, and probably the first recorded from Canada. In conclusion, it is hoped that these imperfect lists and notes thereon may stimulate further observations on the winter habits of Canadian insects.

BIRDS AS PROTECTORS OF ORCHARDS.*

By E. H. Forbush, Ornithologist of the Massachusetts Board of Agriculture.

Having had, during the last twenty years, some opportunity for observing the food habits of birds, I have become convinced that they destroy enormous numbers of insects. This conviction gives rise to the question, to what extent are birds useful to man in this respect?

The present paper is merely a partial record of the results of an attempt to foster and protect birds in an old and neglected orchard with a view to observing the effect of such a policy upon the trees. The orchard is so situated as to be a favorite haunt for birds. It forms part of an estate in Medford, Mass., lying near the southern border of the stretch of wooded rocky hills known as the "Middlesex Fells," a large part of which is now under the control of the Metropolitan Park Commission of Massachusetts, and is being administered as a forest reservation. The nearest estates on the east and west of the orchard are cultivated to some extent. There are other orchards in the immediate vicinity, and many fine and large shade trees. There are also on the estate in question many varieties of trees and shrubs. There is a small piece of woodland, covering perhaps an acre and a half, in which yellow pine predominates, the other trees being principally ash, oak and maple, some hickory and a few white pines. A lane running along the southern border of the estate is bordered on both sides with elms and poplars. A line of mulberry trees along the lane south of the orchard affords tempting food for such birds as are fond of fruit in its season. There are also many wild cherries and berries of several varieties, together with half a dozen trees of cultivated cherries.

Among the trees, shrubs and vines found on the estate and which furnish food for birds in the shape of berries or seeds at certain seasons of the year are the *Berberis vulgaris* (common barberry), *Vitis labrusca* (northern fox grape). *Rhus toxicodendron* (poison ivy), *Prunus Americana* (wild yellow plum), *Prunus Pennsylvanica* (wild red cherry), *Prunus Virginiana* (choke-cherry), *Prunus cevium* (English cherry), *Rubus occidentalis* (black raspberry), *Rubus villosus* (high blackberry), *Rubus idæus* (garden raspberry), *Rosa nitida* (wild rose), *Pyrus malus* (common apple), *Ribes rubrum* (common red currant), *Fraxinus Americana* (white ash), *Morus rubra* (red mulberry), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Pinus strobus* (white pine), *Pinus rigida* (pitch pine), *Thuja Canadensis* (hemlock), *Juniperus Virginiana* (red cedar).

The orchard itself is a typical old orchard, such as is often found on small farms. It has suffered greatly from neglect. Two-thirds of the original trees have died or are in the last stages of dissolution. This is largely the result of neglect and improper pruning. Dead limbs and hollows in the trees have offered nesting places for such birds as the wren, woodpecker and bluebird.

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For three years, from 1891 to 1893, inclusive, the trees were trimmed and cared for. They were sprayed or banded to protect them from canker-worms, and the "nests" of the tent caterpillar (*Clisiocampa Americana*) (Fig. 27), were removed. The result was a scanty yield of apples from most of the trees. One or two bore quite plentifully.

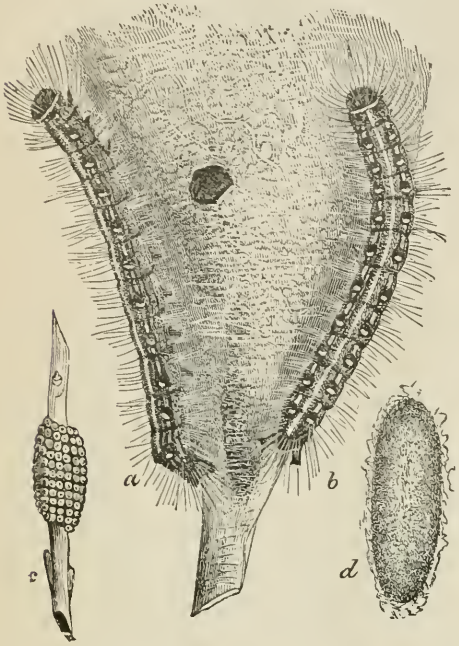

Fig. 27.

In order to observe the effect of the feeding of birds in the orchard, no care was taken in 1894 to protect the trees. During that year the tent caterpillars were very numerous in the vicinity, and it became evident also that a great increase in the the number of canker-worms was taking place in the neighborhood. Although these insects made considerable inroads upon the trees, they did not seriously injure the foliage anywhere except in one or two instances. No attempt was made previous to 1895 to foster or encourage the birds in the neighborhood, except that a few nesting boxes were put up in 1894, which were occupied in one case by a family of wrens, and in another by the English or house sparrow. We were careful, however, to destroy the nests of the house sparrow.

Fig. 28.

In the fall of 1894 it was noticed that immense numbers of the wingless females of the fall canker-worm (*Anisopteryx pometaria*) (Fig. 28, *b*), were ascending nearly all the trees and depositing their eggs; also, that the eggs of the tent caterpillar moths were numerous upon the twigs promising a plentiful supply for 1895.

Having allowed the insects one year to increase unmolested by man, we began in the winter of 1894 95 to encourage the presence of birds in the orchard.

In 1894 a small tree in the centre of the orchard had been enclosed by a high board fence. The tree thus enclosed was used as an outdoor experiment station for observation on the breeding and habits of the gypsy moth. During the winter 1894-95, Mr. C. E. Bailey made frequent visits to this tree to ascertain whether or not the birds were destroying the eggs of the gypsy moth. Incidentally, Mr. Bailey observed many interesting things in connection with the feeding of the birds on the eggs, larvæ and pupæ of insects which wintered on the trees, and I am greatly indebted to him for many interesting notes on the feeding of birds in this orchard. He is a careful, conscientious observer, and is intimately acquainted with most of our native land birds.

Hunters and trappers are aware that many species of winter birds, such as titmice, woodpeckers, crows, jays and nuthatches are attracted by a skinned carcase suspended from a limb, and will remain in the vicinity until all the bones are picked clean or until, with the approach of spring, insect food becomes more accessible.

Believing from my own observations that the chickadees (*Parus atricapillus*) were feeding on the eggs of the fall canker-worm, I asked Mr. Bailey to attract the birds, if possible, to the orchard by suspending pieces of meat, bone, suet, etc., from the trees.

These food materials are suitable for birds at times when the trees are covered with snow or ice and when, lacking such nourishment, they might starve. Although birds will frequently visit bait provided for them and in time will eat a considerable portion of the meat, they do not depend entirely on this aliment, but spend the greater portion of their time in searching for insects and eggs in the immediate vicinity.

Finding a plentiful supply of food, the chickadees remained about the orchard most of the winter, except for a week or two, when the meat gave out, but they were lured back again later by a fresh supply which was placed in the trees. Not only were the chickadees attracted to the orchard in large numbers, but other birds came also. A pair of downy woodpeckers (*Dryobates pubescens*) and two pairs of nuthatches (*Sitta carolinesis*) were frequent visitors, and a few brown creepers (*Certhia Americana*) came occasionally. All these paid frequent visits to the meat and suet, and also thoroughly inspected the trees in search of insect food. They made excursions also to the trees in the neighborhood, but the greater portion of their attention was confined to the orchard in which the bait was suspended. As they became more accustomed to Mr. Bailey's presence they grew quite tame, and could be viewed at a distance of a few feet. Indeed, chickadees frequently alighted on his person and occasionally took food from his hand. He was thus enabled to determine accurately (without killing them) what they were feeding upon, and was soon convinced that they were destroying the eggs of the canker-worm moth in large numbers, as well as the hibernating larvæ and pupæ of other insects injurious to trees.

To determine how many eggs a single chickadee would eat, a few birds were killed and their stomach contents examined, with surprising results. There was no difficulty in identifying the eggs of the canker-worm moth which were found in the birds' stomachs, as a great portion of the shells remained intact. The other insect contents of the stomachs

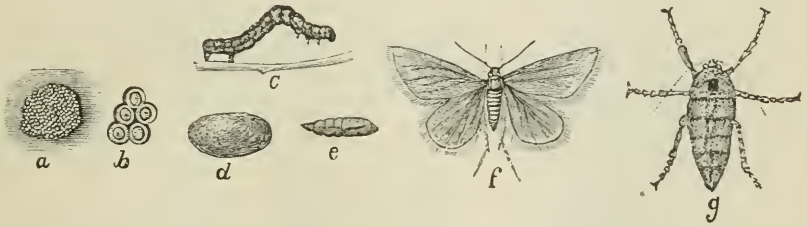

Fig. 29.

were identified for me through the kindness of Mr. A. H. Kirkland, B.Sc., assistant entomologist of the State Board of Agriculture, who made the examinations. Although it was impossible in all cases to learn with certainty the species to which certain insects belonged, it was evident that they belonged to the genera known to be of injurious habits.

I take the following from Mr. Bailey's notes:

Number of Eggs of the Fall Canker-Worm found in Stomachs of Chickadees.

No. 1	273 eggs.
" 2	261 "
" 3	216 "
" 4	278 "

Making in all 1,028 eggs found in the stomachs of four birds. Four birds killed later in the season had eaten the female imagos of the spring canker-worm (*Paleacrita vernata*), (Fig. 29, *g*), as follows:

No. 1	41 moths.
" 2	18 "
" 3	27 "
" 4	19 "

Making a total of 105. In No. 2, 3 and 4 of the last table there were a large number of eggs also. It is safe to say that there were 150 eggs in each stomach, in addition to the female moths eaten.

Mr. Bailey carefully counted the eggs in the ovaries of twenty of these female moths, with the following results:

No. 1	158	No. 11	111
" 2	272	" 12	160
" 3	127	" 13	193
" 4	184	" 14	131
" 5	213	" 15	281
" 6	135	" 16	242
" 7	140	" 17	116
" 8	220	" 18	281
" 9	200	" 19	192
" 10	130	" 20	217

It will be seen from this table that the average number of eggs found in each moth is 185. Mr. Bailey is very positive, from his continuous field observations, that each chickadee will devour on the average thirty female canker-worm moths per day from the 20th of March until the 15th of April, provided these insects are plentiful. If the

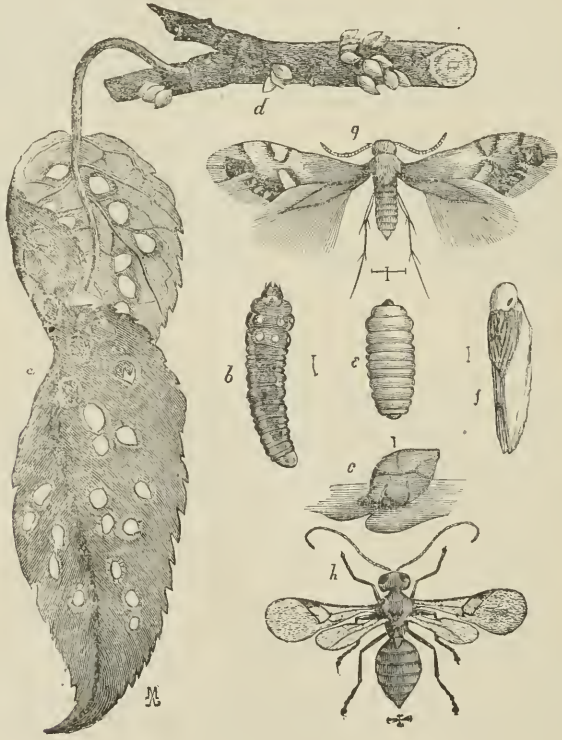

Fig. 30. (Aspidisca splendoriferella.)

average number of eggs laid by each female is 185, one chickadee would thus destroy in one day 5,550 eggs; and in the twenty-five days in which the canker-worm moths "run" or crawl up the trees, 138,750. It may be thought that this computation is excessive, and it is probable that some of the moths were not captured until they had laid some of their eggs, but the chickadees are also busy eating these eggs. When we consider further that forty-one of these insects, distended as they were with eggs, were found at one time in the stomach of one chickadee, and that the digestion of the bird is so rapid that its

stomach was probably filled several times daily, the estimate made by Mr. Bailey seems a very conservative one. He now regards the chickadee as the best friend the farmer has, for the reason that it is with him all the year, and there is no bird that can compare with it in destroying the female moths and their eggs. It was noticed that the birds made no attempt to catch the male moths. This, however, cannot be considered as a fault, for the birds accomplish far more by destroying the females than they would by killing males.

The following notes from the preliminary examinations of the contents of the alimentary canal of chickadees made by Mr. Kirkland are of interest in this connection :

"Bird brought in by Mr. Bailey, March 16, 1895 : Gullet empty. Gizzard contained 270 canker-worm eggs (*Anisopteryx pometaria*), forty-six case-bearers (microlepidoptera), six cocoons, Fig. 30*d*, of a small tineid (near *Aspidisca*). These three kinds of food in bulk composed eighty per cent. of the gizzard contents, the remainder being dark material which I was unable to determine under a hand lens. I think it very probable that part of this was bits of bark or particles of bark dust taken in with the eggs or cocoons. The intestine contained a large quantity of meat, seventy-five per cent., and 103 canker-worm eggs, ten per cent., the remainder, fifteen per cent., being material which I could not identify. It was not meat. This gives us as totals, 373 canker-worm eggs and fifty-one microlepidoptera.

"Specimens of so called 'scales' on apple twigs brought in by Mr, Bailey, March 12, 1895. These are not bark lice, but the cocoons of a microlepidopteron, probably a tineid. Length 1-12 to 1-8 inch : width, 1-12 to 1-10 inch ; elliptical, dark brown or reddish brown. They are closely spun, the upper surface apparently being of leaf epidermis, while underneath is a small well-formed cocoon which contains a minute green larva which evidently hibernates as such, probably pupating in the spring. The larva undoubtedly feeds on the leaves of the apple-tree, as these cocoons were taken from the small twigs at the extreme end of a large branch. Some of these cocoons are empty and have a minute hole at one end, which probably served for the egress of some small parasite. These cocoons are eaten by the chickadee, and have been found in the gizzard of the birds."

The case bearers and the tineids or leaf miners are injurious to the foliage of the apple-trees.

It was noticed by Mr. Bailey, who watched the birds closely for several days, that they were eating quantities of both of these insects. It would have been impossible for any one to determine the species of the leaf miners as found in the birds' stomachs, for little remained but small fragments of the shell of the creature. Mr. Bailey noticed that the birds were taking objects from the twigs, some of which they ate ; others they rejected and dropped upon the snow. Some of those dropped he picked up and examined, finding them to be parasitized. The birds undoubtedly ate only those which were alive.

It was evident from a careful examination of the eggs found in the stomachs of the chickadees that they were either broken by the bill in such a way that the contents were exposed to the action of the gastric juice or the gastric fluid destroyed a portion of the shell. Occasionally a few eggs which appeared to be whole were found in the intestines.

A great quantity of animal food is required to sustain life and provide animal heat sufficient to enable these little birds to resist the inclemency of our severe winters. In proof of this it may be stated that during favorable weather the birds visited the meat and ate largely of it three times each hour with fair regularity. During each interval they were occupied in destroying eggs and other hibernating insect forms which were always present and numerous in the stomachs examined. This feeding appeared to be almost continuous except in severe storms when the birds sought shelter or when they were laboring under excitement caused by fear, as in the case of a visit from a hawk, cat or shrike. Whenever a cat appeared they immediately hid behind the branches and remained quiet until the intruder had passed. The appearance of other enemies or the firing of a gun would produce much the same effect.

The woodpeckers and nuthatches which frequented the orchards, were not seen to eat the eggs of the canker-worm moth. As they were not numerous, none were killed. Mr. Bailey observed, however, that the nuthatches were eating scales which they found on the limbs of the apple-trees in a neighboring orchard. In relation to these scales the following note from Mr. Kirkland is of interest :

"March 20, 1895. Mr. Bailey brought in specimens of apple twigs infested with the Bark Scale louse, *Mytilaspis pomorum*, Fig. 31. He reported that the nuthatch was feeding on them. These twigs were infested in a worse manner than I have ever seen before. They were literally covered with the scales. On one small twig, one-half inch in diameter, I counted 367 scales on one inch of the twig. The eggs contained in a number of scales varied from sixty-two to eighty-two, with an average of seventy."

Fig. 31.

These scales, when numerous, are very injurious to the apple-tree. Each scale covered a dead female of the preceding year and the hibernating eggs, many of which must have been disposed of by the nuthatches. I was shown, both by observation and dissection, that birds feeding in the same neighborhood and upon the same trees showed considerable variance in the character of their food. Kinglets taken, had no canker-worm eggs, but had eaten largely of bark borers. Woodpeckers seemed to confine themselves to the larvæ of borers and to wood-ants and other insects which bore into the wood of the tree. Chickadees and nuthatches ate the pupæ and eggs of insects found upon the bark or in the crevices of the trunks. No birds were seen to eat the eggs of the tent caterpillar, nor were any found in the stomachs of any of the birds examined. It seems probable that these eggs are so protected by a hard covering that they are not eaten by most birds.

It is impossible, in the limited space at our command, to give results of all observations and dissections in detail. We can merely give the apparent results of the presence of the birds in the orchard.

It was found that these birds were not only destroying the eggs of the canker-worm in this orchard, but were feeding on the eggs of the same insect in the woods where bait had been suspended.

As the frost left the ground on the first warm days of spring the wingless females of the spring canker-worm moth appeared in the orchard and began ascending the trees in great numbers. The chickadees commenced catching and eating the females and their eggs. Mr. Bailey placed twenty-two of the females on one tree, and in a few minutes twenty of them were captured and eaten by chickadees.

It was noticed as spring approached and insects became more numerous that the chickadees came very seldom to the meat. They were not as assiduous in their attention to the orchard, and a small portion of their food consisted of the early gnats which were flying on bright sunny days. In early April they had nearly deserted the meat, although they still frequented the orchard in search of the female canker-worm moths. They seemed to prefer animal food to all other, and even in cold weather would hardly notice grain or seeds of any kind, though one individual ate a few oat kernels which were placed near his accustomed feed of meat.

Towards the last of April the English or house sparrow (*Passer domesticus*) began to make its appearance in the vicinity and apparently drove the chickadees to the woods, as they disappeared and did not nest in the orchard, but remained in the woods, where they paired and nested.

I believe that the English sparrow is largely responsible for the fact that chickadees are not now found nesting in our orchards. Though they still nest in the orchards on the remoter farms and in the villages where the English sparrow is not numerous, they seem to have disappeared in summer from orchards near cities. At the time of the advent

of the sparrow in this locality, twenty-five years ago, chickadees were often found nesting in old apple trees in the orchards in this region where now scarcely any are to be seen in orchards during the summer.

In the latter part of April and in early May the tent caterpillars made appearance on the apple and cherry trees in the neighborhood. Canker-worms were also numerous on the apples and elms and appeared in some of the other trees. It was noticed, however, that while trees in neighboring orchards were seriously infested with canker-worms and to a less degree with tent-caterpillars, those in the orchard which had been frequented by the chickadees during the winter and spring were not seriously infested, and that comparatively few of the worms and caterpillars were to be found there.

With the warm south winds of May, many summer birds came and settled in the neighborhood and prepared to build their nests, among which the following were seen: Chickadee (*Parus atricapillus*), Tree Sparrow (*Spizella monticola*), Crow (*Corvus Americanus*), Purple Grackle (*Quiscalus quiscula*), Flicker (*Colaptes auratus*), Red-winged Blackbird (*Agelaius phœniceus*), Robin (*Merula migratoria*), Chipping Sparrow (*Spizella socialis*), Ovenbird (*Seiurus aurocapillus*), Wood Thrush (*Turdus mustelinus*), Catbird (*Galeoscoptes carolinensis*), Brown Thrasher (*Harporhynchus rufus*), Black-billed Cuckoo (*Coccyzus erythropthalmus*), Yellow-billed Cuckoo (*Coccyzus Americanus*), Black and White Warbler (*Mniotilta varia*), Yellow Warbler (*Dendroica æstiva*), Chestnut sided Warbler (*Dendroica Pennsylvanica*), Black-throated Green Warbler (*Dendroica virens*), Pine Warbler (*Dendroica vigorsii*), House Wren (*Troglodytes ædon*), American Redstart (*Setophaga ruticilla*), Nashville Warbler (*Helminthophila ruficapilla*), Golden-winged Warbler (*Helminthophila chrysoptera*), Scarlet Tanager (*Piranga erythromelas*), Rose-breasted Grosbeak (*Habia ludoviciana*), Baltimore Oriole (*Icterus galbula*), Blue Jay (*Cyanocitta cristata*), Least Flycatcher (*Empidonax minimus*), Wood Pewee (*Contopus virens*) Phœbe (*Savornis phœbe*), Kingbird (*Tyrannus tyrannus*), and Downy Woodpecker (*Dryobates pubescens*).

It was noticeable that early in the season, when the webs of the tent-caterpillar (Fig. 27) first appeared on the apple and cherry trees, the orioles attacked them and devoured a considerable number of the hairy young larvæ. A little later, when the canker-worms became more numerous, it seemed as if all the birds in the neighborhood were intent on eating canker-worms, neglecting to a certain extent the hairy caterpillars. The cuckoos, however, seemed to feed impartially on both the canker-worm and the tent caterpillar.

Birds from all quarters in the wood and swamp, orchard and field, flocked into the trees infested by canker-worms, and there spent a considerable portion of their time. In a short time the few canker-worms remaining in the old orchard were apparently eaten by birds, and the birds then directed their attention to the neighboring orchards, which were swarming with the worms It soon became evident that these orchards would be entirely stripped of their leaves, while the old orchard retained its full foliage. Thus it was seen that the trees to which the chickadees had been lured during the winter had been so well protected that the summer birds were able to destroy the few remaining larvæ, while the trees at a distance from these contained so many larvæ that the birds were not numerous enough to dispose of them or to make any effective reduction in their numbers. This apparently demonstrated the usefulness of the egg-destroying winter birds, and showed the wisdom of attracting them to the orchard during the winter months. Not only did nearly all species of birds in the neighborhood flock to the trees infested by the canker-worms, but the chickadees, living in their retirement in the woods, came out to the orchards, flying some distance to procure canker-worms with which to feed their young, and making regular trips to the infested trees day after day.

On May 18, Mr. Bailey saw a female chickadee carry twenty larvæ to its nest. They were apparently all canker-worms but two, which were tent caterpillars. Of this he is certain, for he was within three yards of the nest to which the larvæ were taken. Later, on May 31, he noticed the chickadees feeding their young. It was evident that a large portion of the food consisted of canker-worms. The birds each made a trip to the nest about once in twelve minutes. The male and female came at nearly the same time

and went away together. They went in the direction of an orchard infested by canker-worms. A few of the larvæ were dropped on the ground at the nest and proved, on examination, to be canker-worms.

The crow was also observed feeding on the canker-worms.

On May 22 the birds had nearly all stopped feeding in the neighboring woods and were in the orchards feeding on canker-worms.

Early in June, when the remaining canker-worms had finished their transformations and retired to the ground, several species of birds were again noticed feeding their young on the tent and other hairy caterpillars. Of these, three species (both cuckoos and the Baltimore oriole) seemed to be the most useful. On May 17, a cuckoo was seen to take eleven caterpillars out of one nest. Mr. Bailey writes: "On May 10, a black-billed cuckoo came into a tree near me at 3 p.m. and sat there until 4.40 p.m., then he went straight to a tent caterpillars' nest. He looked it over for a short time and then commenced eating the caterpillars. He picked twenty-seven caterpillars out of the nest before he stopped. The bird ate them all and did not drop one. Then he went to the tree, in which, I believe, he remained during the night, for on Saturday, the 11th, I found the bird in the same tree, and in almost the same place, at 5 a.m."

The orioles, chickadees and vireos often pecked the caterpillars to pieces and ate portions of them, seemingly feeding to a considerable extent on the internal organs. This being the case, it is quite evident that the stomach contents cannot be depended upon entirely to determine the character of the food of these birds, as no one is expert enough to identify the internal organs of caterpillars with such certainty as to determine the species to which they belong.

The following is a list of the birds seen feeding on the tent caterpillar:

Crow (*Corvus Americanus*), Chickadee (*Parus atricapillus*), Oriole (*Icturus galbula*), Red-eyed Vireo (*Vireo olivaceus*), Yellow-billed Cuckoo (*Coccyzus Americanus*), Black-billed Cuckoo (*Coccyzus erythrophthalmus*), Chipping Sparrow (*Spizella socialis*), Yellow Warbler (*Dendroica æstiva*).

During the month of May an attempt was made to render the place as attractive to birds as possible. The undergrowth, which previous to 1894 had been trimmed out, was afterward allowed to grow, and in 1895 several low thickets had been thus formed. The mulberry-trees were stimulated by judicious trimming, and bore a considerable crop of early fruit which ripened in advance of the cherries, thus drawing the attention of the fruit-eating birds away from the cherries, and serving to attract them to the vicinity of the orchard. Ten nesting boxes were put up for the wrens and bluebirds; but as the bluebirds were very rare this season none came to the orchard. Two families of wrens, however, were reared in the boxes in place of one family last year. Nesting materials—strings, hair and straw—were hung in the trees and scattered about. Several marauding cats were killed, and an attempt was made to keep nest-hunting boys away from the neighborhood as much as possible. Thirty-six nests of birds were discovered in the neighborhood, as follows: Three red-eyed vireos, ten robins, four Baltimore orioles, three cuckoos, five chipping sparrows, three least flycatchers, two redstarts, two yellow warblers, two chickadees, two house wrens.

Of these all but three were destroyed probably by boys, the nests being torn down and the eggs missing. The three which escaped destruction were two wrens' nests which had been built in boxes upon buildings, and a robin's nest in a maple tree within ten feet of a chamber window. This wholesale destruction of nests discouraged several pairs of birds, and they disappeared from the neighborhood. Those remaining built new nests, and after a second or third attempt a few succeeded in rearing young. One nest of orioles escaped the general destruction, and the birds were busy for a long time carrying canker-worms to their young. One of them was noticed to take eleven canker-worms in its beak at one time, and fly with them to the nest. The vireos, warblers, chickadees, cuckoos, orioles and chipping sparrows were particularly active in catching canker-worms, and the English sparrow killed them in considerable numbers.

If the thirty-six pairs of birds whose nests were found had succeeded in raising their young, it is probable that they would have disposed of most of the canker-worms in the neighborhood. Five thousand of these larvæ are sufficient to strip a large apple-tree. One hundred and eight young would have been reared, had each pair of birds raised three. According to Professor Augley's experience, sixty insects per day as food for each bird, both young and old, would be a very low estimate.* Suppose each of these one hundred and eight birds had received its sixty insects per day, there would have been 6,480 caterpillars destroyed daily. The destruction of this number of caterpillars would be enough to save the foliage and fruitage of one apple-tree. In thirty days the foliage of thirty apple trees could have been saved, or 194,400 canker-worms destroyed. This does not include what the old birds themselves would have eaten.

In these observations, the influence of insect parasites and predaceous insects has not been entirely ignored. Hymenopterous parasites were not seen to be numerous, and as it was a year when canker-worms were on the increase, it is not probable that these parasites would have been a prime force in reducing the numbers of the canker-worms had the birds not been present. Even had they been numerous they would have had little effect in checking the ravages of the canker-worm during the present year, as their interest is identical with that of the canker-worm, and they remain in its body until it has finished feeding, allowing it to defoliate the trees before completing their deadly work upon it.

We do not know to what extent such parasites are devoured by birds. This we could not ascertain without shooting the birds, which would have defeated our main object. No parasites of the tent caterpillar or canker-worm were found in the stomachs of the few birds which were examined. It is hardly safe to draw conclusions from observations so limited in their scope, but we may infer from what was observed that the egg-eating birds are of the greatest value to the farmer, as they feed almost entirely on injurious insects and their eggs, and are present all winter when other birds are absent. The summer birds which attack the larvæ are valuable also if they can be so protected and fostered as to become sufficiently numerous to do the work required. It is evident also that a diversity of plants which encourages diversified insect life, and assures an abundance of fruits and seeds, as an attraction to birds, will insure their presence. In this connection, I wish particularly to note the fact that the mulberry-trees, which ripen their berries in June, proved to be a protection to the cultivated cherries, as the fruit-eating birds seemed to prefer them to the cherries, perhaps because they ripen somewhat earlier.

I believe it would be wise for the farmer to plant rows of these trees near his orchard, and it is possible that the early June berry or shad berry (*Amelanchier Canadensis*) might also be useful in this respect. It is a handsome shrub or tree, flowering early in the season, and would be attractive at a time when other trees and shrubs are not in bloom.

At the present time, July 23, 1895, the trees in the orchard appear to be in good condition. They have not suffered from the slight pruning of their foliage which was effected by the few caterpillars and canker-worms which survived. The fruit is well set, and it now remains to be seen whether the birds will have any considerable effect in preventing the ravages of the codling moth. No other orchard in the neighborhood will produce any fruit this season, with one exception. The nearest orchard, situated directly opposite on the estate across the way, has not been ravaged by the canker-worms. This exemption is due principally to the efforts of the owner, who has banded his trees with tarred paper and has used tree ink faithfully and well upon the paper. He has also taken pains to clear the nests of the tent caterpillar from the trees. This orchard, being nearest to the one visited by the chickadees, was also an object of their attention, and this may account somewhat for the reduction of the pests in this place.

The record of these observations, incomplete as it is, is given for what it is worth as a contribution to the literature on this most interesting and important subject.

* 1st Rep. U. S. Ent. Com. 1877, p. 342.

THE ROCKY MOUNTAIN LOCUST AND ITS ALLIES IN CANADA.

By Samuel H. Scudder.

The genus Melanoplus, to which the Rocky Mountain Locust belongs, forms part of a small group of genera first definitely separated a few years ago by Brunner von Wattenwyl under the name of Pezotettiges, but which, for reasons given in a technical memoir now in press, I have preferred to call after the dominant genus just mentioned,—Melanopli.

In the last resort, the Melanopli are separated from their nearest allies only by such an apparently insignificant matter as the number of spines (in itself variable) found on the outer margin of the hind tibiæ; these, save for individual exceptions, often on one side of the body only, are always at least nine in number and rarely exceed fourteen. In the known Canadian species they range from eight to thirteen, but ten or eleven is the almost invariable number.

The Melanopli are an almost exclusively American group comprising more than thirty genera of which only one, Podisma, occurs in the old world. They are primarily divided into two sections, dependent on the shape of the subgenital plate of the males, a division

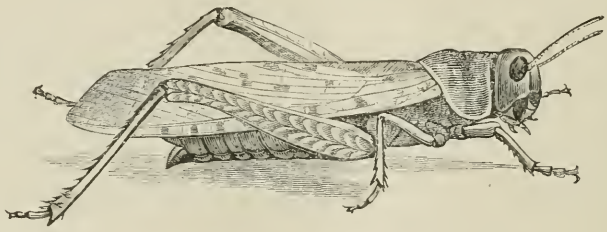

Fig. 32. Locust (magnified.)

which broadly but not exactly separates the tropical or subtropical genera from those of the temperate regions, and leaves an almost equal number of genera in each section. Of the tropical section, as it may be called, but a single genus is known in Canada, Hypochlora; its single species *H. alba* (Dodge) is reported by Brunner as occurring in Manitoba, and this is altogether probable as it ranges along the border in the United States from Minnesota to Montana, but extends south only to Kansas and Colorado. It is a slender, hoary green, long-legged insect with abbreviated tegmina, and is partial to the white sage, *Artemisia ludoviciana.*

Of the temperate section, only three of the genera are actually known to inhabit Canada, though, as we shall see, there is little doubt that others will be found there. One of these is Podisma, formerly known as Pezotettix*, a genus remarkable among the Melanopli for its longitudinal range, which is around the globe north of Lat. 35° N.; for its penchant for high altitudes, many of the species occurring only above or at the forest line on high mountains; and for the wide separation of its sternal lobes, though this alone will not separate it from all Melanopli. Moreover its organs of flight are never completely developed and may often be altogether wanting, as may then also, though in none of our American species, the tympanum found on the sides of the first abdominal segment; as this tympanum is regarded as an auditory apparatus, and as the power of producing sound is gone with the loss of the tegmina (against which the femora are scraped,) the absence of the tympanum in some apterous European species would seem to indicate that they had departed the more widely from the original type, and had therefore a longer history behind them.

* See Psyche, vii, 195.

Up to the present time more species of Podisma are known from the old than from the new world ; in the latter they are not known over a continuous territory, but over two large areas, one in the east and one in the west. That in the east is inhabited by only two species, one of which is only known from Ithaca, N.Y., at less than 500' above the sea, while the other, the better and long known *Podisma glacialis* (Scudd.,) was first found at the timber line in the white mountains of New Hampshire, and has since been obtained at high elevations 2-4500' above the sea, in Maine on Ktaadn and in the country about the Megalloway, in New Hampshire on Kearsarge in Bartlett, in Massachusetts on Greylock in Berkshire county, and in New York in the Adirondacks ; while Mr. James Fletcher and I came across it at the edge of the town of Sudbury in Ontario. It will doubtlesss be found also in Quebec if sought in the proper places ; it is not found upon the ground but upon bushes, in the white mountains on the dwarf birch. Bruner also credits it to " British America," but I do not know from what point he received it, and on enquiry I find it was probably a mistake.

The western area from which Podisma occurs has half a dozen species, which range along the rocky mountains from New Mexico to Alberta ; all of the species are found on the mountain slopes or in Alpine valleys, and most of them at or above the timber line. A single species only is known to inhabit Canada, *Podisma Oregonensis* (Thom.,) which has been taken at Fort McLeod in Alberta, and is also known from Montana, Idaho and Oregon. It is highly probable that other and possibly new species will be found in the Canadian Rockies ; it is especially likely that *Pod. dodgei* (Thom.,) one of the commonest alpine orthoptera in Colorado, and known also from Wyoming and Montana, will occur near timber line in Canada.

A second genus of the section which occurs in Canada is Phœtaliotes, a group founded by me for a single species, the somewhat anomalous insect *Phœtaliotes Nebrascencis* (Thom.,) of which *Pezotettix megacephala* Thom , *Pezotettix autumnalis* Dodge, and *Caloptenus volucris* Dodge, are all synonyms. It has a large, prominent, tumid head, which with a subsellate pronotum gives it a peculiar appearance ; it is strikingly dimorphic, full-winged and half-winged, which accounts for a part of the synonymy. In Canada it has been found only in Alberta at Fort McLeod and in Assiniboia at Medicine Hat, but it ranges from here, skirting the eastern slope of the Rocky Mountains, to Texas and even to Central Mexico. I have not seen the long-winged form, volucris, from Canada, but it occurs from Mexico to Montana.

We have left for the last (though in systematic sequence it should have preceded Phœtaliotes) the typical, dominant genus Melanoplus, which contains most of the known Canadian species. This genus is so strikingly dominant as to contain more than one-half of the known Melanopli of the world. In the memoir referred to at the outset, I have described in detail no less than 131 species, all from North America and all but a very few found within the limits of the United States ; it finds its principal home in the west, and it is to this genus that the Rocky Mountain Locust and several other minor depredators belong. To handle the genus properly I found it advisable to separate it into twenty-eight groups or series, defined mainly in terms of the male abdominal appendages, which here attain a striking and highly diversified development, and to name the groups after the predominant or older species contained in it. In that order I will present them also in the present account. Many of these species have before been placed under Pezotettix (Podisma) when I and others were accustomed, without careful discrimination, to look upon all the short-winged forms as belonging to that genus and the long-winged ones to Melanoplus. As some species are dimorphic, either fully winged or practically unable to fly from the brevity of the alary organs, that custom had its disadvantages, and a careful study of our entire Melanoplan fauna became a great desideratum, which I trust I may be found to have successfully filled in the paper before referred to.

In the *Glaucipes series*, there is a single species, *Mel. kennicottii* Scudd., a very small full-winged insect, which must be tolerably widespread in Canada, since it has been brought from the Yukon river in Alaska and the Souris river in Assiniboia, and occurs also in Montana.

In the *Utahensis series*, *Mel. bruneri* Scudd., a new species of about the size and general appearance of *Mel. femur-rubrum* but the male with a strongly upturned, apically broad subgenital plate occurs in Alberta at Fort McLeod, and extends from there southward to Nebraska and Colorado, and westward to Washington.

But it is in the *Spretus series* that the largest number of Canadian species appear. Most of them are closely allied to *Mel. atlanis*. Here are, first, *Mel. Alaskanus* Scudd., a new species found in Alaska and taken also at Spilmacheen, British Columbia; next, *Mel. affinis* Brun., another new species found in British Columbia, Washington, Utah and Wyoming; then, *Mel. bilituratus* (Walk.,) a common species on Vancouver Island, as well as on the mainland in British Columbia, and over the border in Washington, Oregon, Nevada and Montana; *Mel. atlanis* (Riley,) an extremely abundant insect, occurring throughout the breadth of Canada, from Sable Island, off Nova Scotia, to Vancouver; it extends northward to the Yukon river in the west, though in the east I have only seen or heard of it as far north as Quebec, Ottawa, Sudbury and Lake Winnipeg; and finally, *Mel. spretus* (Uhl.,) the Rocky Mountain Locust, the arch-destroyer, whose home is in the high plateaux of the Rocky Mountains and their eastern versant as far north as the Saskatchewan, and which now and again ravages the country to the east by its migrating hordes.

In the *Dawsoni series* there are two Canadian species: *Mel. Dawsoni* (Scudd.,) which occurs in Canada from Manitoba to Alberta, and has two forms, long-winged and short-winged. Only the latter has been found in Canada, and the species ranges to New Mexico. The other Canadian species is *Mel. Gladstoni* Brun., which has been found at Medicine Hat in Assiniboia, and southward to Nebraska. Both these species are small and inconspicuous.

In the *Fasciatus series* are also two Canadian species: *Mel. fasciatus* (Walk.,) widespread in Canada, having been reported or seen by me from Newfoundland, Labrador north of the Straits of Belle Isle, Anticosti, Hudson Bay, Lake of the Woods, Manitoba, Saskatchewan, Assiniboia, Alberta and Alaska. It also occurs in the United States everywhere near the Canadian border, from ocean to ocean, and as far south as New Jersey, Missouri and Colorado. It again is dimorphic, but the wings in the brachypterous form are not very short, and the full-winged form is known only from Michigan. The second species of this group is the only Canadian species not found in the United States, *Mel. borealis* (Fieb.) I have seen it only from the barren grounds of northern Labrador, but it is also reported from Hudson Bay and Greenland. It has slightly abbreviated organs of flight.

In the *Femur-rubrum series* the well known *Mel. femur-rubrum* (DeGeer), Fig. 33 occurs over nearly the whole of Canada, from ocean to ocean, wanting only in some northernmost localities, such as Labrador; and a second species, *Mel. extremus* (Walk.), ranges from Quebec to the Yukon and is dimorphic, though the organs are half as long as the body in the brachypterous type. The macropterous form seems to affect high altitudes or latitudes. I have seen specimens from the Alpine districts of the White Mountains and from Arctic America, among other places.

b

Fig. 33.

In the *Angustipennis series* the only Canadian species is *Mel. coccineipes* Scudd., a new species of moderately large size, found not uncommonly in Nebraska, Kansas, Colorado and Utah, and of which I took some specimens in company with Mr. Fletcher, at Nepigon, Lake Superior.

Mel. packardii Scudd., is the only Canadian species of the *Packardii series*, but this occurs abundantly from Assiniboia to British Columbia. South of the border it occurs over most of the United States west of the 100th meridian.

In the *Collinus series*, where all the males have forked cerci, there are several Canadian species: *Mel. alpinus* Brun., a very small new species, which ranges from Alberta to British Columbia, and is also known from Idaho; *Mel. infantilis* Scudd., a still smaller form, originally described from Colorado, but found also in Assiniboia (Medicine Hat),

and Alberta (Fort McLeod); and *Mel. minor* (Scudd.), a tolerably common species in the United States from Maine to the Rocky Mountains, and which was long ago sent from Red River, Manitoba, by Robert Kennicott and Donald Gunn.

Finally, in the *Bivittatus series*, where the species are large (the largest of those found in Canada), we find *Mel. femoratus* (Burm.,) which ranges from Nova Scotia to British Columbia, and extends as far north as Hudson Bay. In the United States it extends southward nearly to the Ohio, and on the Atlantic coast even to North Carolina, while in the west it is nearly confined to the northern tier of states, though it reaches along the Rockies to Colorado and along the Sierras to northern California. A second species, intimately related to the other, but with parti-colored instead of clear red hind tibiæ, *Mel. bivittatus* (Say), is a more southern form, but it occurs with the first in many places, and, in Canada, accompanies it from British Columbia to Manitoba, but not eastward.

It thus appears that ten of the twenty-eight series found in the genus Melanoplus occur in Canada, though but twenty species, or less than one-sixth of the known forms, are included in the list. The list is remarkable for three things: 1, the range of structural diversity as indicated by the number of series represented; 2, the total absence of all species with excessively abbreviated tegmina (*i.e.* only as long or scarcely longer than the pronotum), such as would formerly have been placed unquestioned in Pezotettix, the single one of the known Canadian Melanopli with such tegmina being a true Podisma; 3, that it includes three of the only four well marked cases of wing-dimorphism in the genus Melanoplus. It is true that both the dimorphic forms have not been found in Canada, but that is in all probability a mere accident, collections from Canada being much rarer. The dimorphism is probably co-extensive or nearly so with the species.

But it should not be concluded that the above list actually offers a fair idea of the true Melanoplan fauna of Canada. Canada is so little explored from a natural history standpoint, especially in its western portions where, in the United States, Melanopli are so very strikingly diversified, and so many additional forms have been found next the Canadian border, that we must believe that many of them surpass it and are not now known as Canadian, simply from the little attention paid in Canada to this order of insects. We propose, therefore, to conclude this account by a brief review of such Melanopli as may be looked for with some confidence; we shall discover the probability of a much more varied and numerous series, for the number of genera and species will both be doubled, and the "series" of the genus Melanoplus represented raised from ten to seventeen. All the additional genera, however, belong to the temperate section.

In the first place we may cite Hesperotettix as a probable inhabitant, since *Hesp. pratensis* Scudd., is widely diffused along the northern margin of the United States, from Minnesota to Washington, being recorded in my paper from these two States and all the intervening ones.

Then there is the genus Bradynotes, containing peculiarly broad-chested, robust forms with mere pads for tegmina, all the species of which are confined, so far as known, to the extreme northwest of the United States,—Washington, Oregon, Northern California and Idaho, with Nevada, Montana and Wyoming. No less than four species are found in Washington and two others in Idaho, besides one confined to California, so that it seems altogether probable that one or more of them may be found in British Columbia, if indeed this district do not prove to have its peculiar species.

The genus Œdaleonotus, founded by me on the species I formerly described as *Pezotettix enigma*, a clumsy bodied insect with tumid prozona and stout femora, and strikingly dimorphic in its tegmina, ranges on the Pacific coast from Southern California to Northern Washington where it is abundant, and it may almost surely be looked for in British Columbia.

Another new genus, Asemoplus, created for the reception of Bruner's *Bradynotes Montanus*, a relatively slender form, likewise with lobiform tegmina, has been found hitherto only in Montana and Washington and not further south, so that it probably ranges northward across the boundary.

To turn to the genera known to be represented in Canada, we have already mentioned the probability that *Podisma dodgei* (Thom.,) would occur in the Canadian Rockies; and it is by no means improbable that new species of this genus will also be found.

But for the bulk of the suspects we must naturally turn to the genus Melanoplus. Here, in the *Flabellifer series*, we have *Mel. occidentalis* (Thom.,) known from Minnesota, North Dakota, Wyoming and Montana; and *Mel. flabellifer* Scudd., occurring in Wyoming, Montana and Idaho.

In the *Spretus series*, *Mel. intermedius* Brun., occurs abundantly in Wyoming, Montana, Idaho and Washington, and is, therefore, likely to occur in Alberta and British Columbia.

The *Indigens series* is composed of a single and new species, *Mel. indigens*, which comes from Idaho and may reasonably be looked for a little further north.

The *Mancus series* is another group not yet discovered in Canada, but which may be looked for, as two species, *Mel. Artemisiæ* (Brun.,) and *Mel. mancus* (Smith) are found on its confines: the former in the west on sage brush in Idaho; the latter in the east in Maine and New Hampshire.

In the *Dawsoni series*, an additional species may be looked for, viz: *Mel. militaris* Scudd., which occurs in Idaho.

Several species also of the *Rusticus series*, a group not yet recognized in Canada, probably occur therein: *Mel. Montanus* (Thom.,) found in Montana, *Mel. Washingtonianus* (Brun.,) known now only in Washington, and *Mel. altitudinum* (Scudd.,) which occurs at high elevations in Wyoming, South Dakota and Montana.

Of the *Borckii series*, *Mel. borckii* (Stal.,) is found in Washington, Idaho and Montana.

So, too, in the *Fasciatus series*, *Mel. saltator* (Scudd.,) occurs in the same States and in Wyoming, and may confidently be expected to extend across the border.

The *Alleni series* contains but two species, one of which, *Mel. Alleni* (Scudd.,) occurs in Iowa and Dakota.

One of the representatives of the *Cinereus series*, *Mel. cinereus* (Scudd.,) is of a very wide range, and is known from Washington, Idaho and Wyoming in places very similar to those abundant over the border in the sage-brush district.

Finally the *Collinus series* has probably other representatives in Canada, since *Mel. luridus* (Dodge) occurs abundantly in Washington, Montana, Dakota and Wyoming, and *Mel. collinus* (Scudd.,) is found in equal numbers in Maine and New Hampshire.

A considerable number of these species have tegmina no longer than the pronotum, so that should eventually all of them be found in Canada, what has before been said on this point regarding Canadian species would need to be materially modified. But in any event it seems plain that the Canadian fauna will prove much richer in species and genera than we now know it to be.

It should be added that many of the species mentioned above are as yet unpublished and are not always so specified; descriptions of all are in press.

SEVENTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.*

The Association met in room 4, High School building, Springfield, Mass., August 27th, 1895. The following officers and members were present :

President John B. Smith, New Brunswick, N. J. ; Vice-President, C. H. Fernald, Amherst, Mass. ; Secretary, C. L. Marlatt, Washington, D. C. ; R. A. Cooley, Amherst, Mass. ; G. C. Davis, Agricultural College, Mich. ; E. H. Forbush, Malden, Mass. ; L. O. Howard, Washington, D. C. ; A. H. Kirkland, Malden, Mass. ; J. A. Lintner, Albany, N. Y. ; C. V. Riley, Washington, D. C. ; P. H. Rolfs, Lake City, Fla. ; F. A. Sirrine, Jamaica, N.Y. ; E. B. Southwick, Central Park, New York City ; F. M. Webster, Wooster, Ohio ; C. M. Weed, Durham, N. H.

There were also in attendance upon the meetings members of other scientific associations and entomologistis not members of the Association, among the latter Mr. George Dimmock and Professor Macloskie. The attendance at the different meetings ranged from 20 to 40.

The Association was called to order by the President and reports from officers listened to. The amendment to the constitution proposed by Mr. Summers, November 13th, 1890, but not afterwards taken up, was adopted. It reads as follows :

SEC. 3. The membership shall be confined to workers in economic entomology. All economic entomologists employed by the General or State governments, or by the State experiment stations, or by any agricultural or horticultural association, and all teachers of economic entomology in educational institutes, may become members of the Association by transmitting the proper credentials to the Secretary and by authorizing him to sign their names to this constitution. Other persons engaged in practical work in economic entomology may be elected by a two-thirds vote of the members present at any regular meeting of the Association. Members residing out of the United States or Canada shall be designated foreign members. Foreign members shall not be entitled to hold office or to vote.

The following persons were elected active members of the Association :

Mr. W. Hague Harrington, Ottawa, Canada ; Mr. R. E. Palmer, inspector of fruit pests, British Columbia. Proposed by Mr. Fletcher.

Mr. W. S. Bullard, Bridgeport, Conn. ; Mr. John Gifford, State forestry agent, Mays Landing, N.J. Proposed by Mr. Howard.

Mr. E. A. Schwarz, Washington, D.C. Proposed by Mr. Marlatt.

Mr. E. H. Forbush, Malden, Mass. ; Mr. A. H. Kirkland, Malden, Mass. ; Mr. R. A. Cooley, Amherst, Mass. Proposed by Professor Fernald.

Mr. F. W. Urich, honorable secretary Victoria Institute, Trinidad, and Trinidad Field Naturalists' Club.

The annual address of the President, John B Smith, was entitled "Entomological Notes and Problems." He drew attention to the fact "that differences in results obtained by farmers do not always argue ignorance or carelessness, and that insects or insecticides may vary, either in resisting power or in effectiveness, in different localities, and that we must not hastily conclude that what answers in California will be equally effective in New Jersey, nor that the conclusions based upon the most careful experiments made in New York can be accepted unquestioned in Idaho," and stated, "that there are factors not yet understood by us that should make us cautious in recommending too positively or hastily measures based on results reached in localities different from our own, and on the other hand should make us very chary in condemning work done by a confrere because our results do not agree with his."

"The day of testing insecticides is therefore not so nearly over as has been sometimes thought, and we owe it to our constituent, where his results do not agree with our expectations, to test the matter under his conditions before deciding him incompetent ; and it does not need the distance between the Atlantic and Pacific to make a difference in condition. Results obtained annually by dozens of farmers in New Jersey seem absolutely

*Through the kindness of Mr. L. O. Howard, Entomologist of the Department of Agriculture, Washington, D.C., we are enabled to give the following account of this interesting meeting.

unobtainable by most careful experiments made in New York; while I have this season proved, much to my dissatisfaction, that the reverse may be equally true, for I can not secure the results in actual practice with bisulphide of carbon against cabbage maggots which Mr. Slingerland obtained in his experiments. Yet Mr. Slingerland undoubtedly recorded only what he found, and sooner or later the reason for the failure in New Jersey will be discovered. Each worker must therefore study his own field most carefully."

He next took up the question of how to control the publication of entomological matter in newspapers in order to prevent the dissemination of erroneous statements, and mentioned the difficulties that he encountered in his efforts to do so. He then referred to the impossibility of keeping track of everything that is published on economic entomology, referring not only to bulletins and reports, but also to the articles published in agricultural journals and newspapers, and asked whether there might not be some feasible way of interchanging among the members of the Association, records of all articles containing original or useful information. He also suggested that some arrangement should be adopted for the interchange amongst the members of specimens of injurious insects and their work, and also the formation of a central collection of economic entomology.

He then dealt with the subject of legislation against insect pests and referred to the difficulty of arousing public opinion sufficiently in order to secure action. He also dwelt upon the importance of having some kind of inspection of trees and shrubs grown in nurseries before they were sent broadcast over the country.

"Perhaps I have spoken enough of problems and of difficulties—he went on to say—and should mention some of the accomplishments, some problems solved. Unfortunately there are none. Progress there has been in many directions, and of the most encouraging kind, but no striking successes, no epoch-making discoveries. We have not yet succeeded, for instance, in dealing more satisfactorily with grasshoppers; but it is decided progress to learn that in a single State several hundred 'hopper-dozers' are in use under the direction of the entomologist and that the State has realized the importance and necessity of this kind of work. Our good friend and fellow-member, Dr. Otto Lugger, has certainly succeeded in securing respect for his profession and a reduction of his preachings to practice.

"Chinch-bug work continues in a number of States; but we are not much nearer a final decision concerning the actual value of the Sporotrichum as a destructive agent. The chief objection to it seems to be that it requires the intelligent co-operation of the weather to secure the best results, and the weather is notoriously unreliable except in so far that you may count with reasonable certainty that it will not be as you want it.

"In this very State of Massachusetts we have a striking example of a destructive increase of an imported pest—the gypsy moth—and an interesting experiment in the direction of its destruction by the State. There are to be two papers on this subject, I am informed, and there will probably be a discussion on the principles concerned in the matter of dealing with imported pests. But I will take the liberty of offering just a few remarks here, not on the methods employed, but on the general principles involved. Under our scheme of government the individual States jealously reserve to themselves all matters of internal interest, and the Federal authorities are excluded from all save a fairly well-determined class of subjects. But no State seems to owe any duty to its neighbors, and Connecticut cannot force Massachusetts to protect it from an invasion by any Massachusetts pest, nor can it claim damages for any resulting injury. Each State is thrown upon its own resources for the protection of its own citizens. Connecticut took no steps to restrain the spread of the pear midge, and New York and New Jersey, though they are sufferers by the neglect, can make no complaint; but these States have in turn left the matter to individual effort, and Pennsylvania and Delaware, when their turn comes, will most likely adopt the same policy of non-interference. There is nothing, in other words, to prevent the spread of this insect over the entire United States except the limitations imposed by nature itself. Just what they are remains to be seen.

"Massachusetts owes no duty to other States to protect them from the gypsy moth. She owes a duty to her citizens only, to the extent that her citizens in a legal way them-

selves determine by their own representatives. If in protecting themselves they protect their neighbors also, they deserve no credit for this result and have no claim for assistance. Yet it is a very grave question whether Massachusetts is not entitled to the assistance of her neighbors or of the general government in her efforts to exterminate this insect. I am offering no opinion as to the possibility of extermination—I have expressed myself both ways and cannot find another—but is not this really a matter of national importance, and should not the national government have certain duties or powers in cases of this kind?

"It is said that nothing is wholly bad, and so I find it possible to see a good feature even in the continued spread and increased injury caused by such imported pests as the elm leaf-beetle. I believe that this creature has done more to arouse public interest in economic entomology than any other single factor for many years past. Our cities are the centres of public interest nowadays, and our metropolitan press voices its expression. Insect injury to agricultural products rarely excites more than a passing curiosity, but the depredations of shade-tree insects in streets, parks, or near-by country roads, and on the grounds surrounding country houses attract attention immediately and produce loud and continuous complaints. The press is interested, and through it the public, while those most vitally affected, the owners of fine shade trees, are induced to examine into a question which they would otherwise have considered as of not the least practical interest. It is from this point of view that I welcome the recent great spread and increased injury from this elm leaf-beetle. City and town authorities and village improvement societies have taken up the matter, have inquired into it, and have even made some more or less successful experiments; and these, if continued, as they must be from the nature of the case, will produce an increased interest in and appreciation of economic entomology. Insecticide machinery and a knowledge of the application of remedial measures against the more common pests will be required of each park department and its employees, and the entomologist will be as important an officer as the landscape gardener. * * *

"I have noted an increasing tendency of late to attempt the control of insect pests by methods of cultivation or farm practice, and this, in my opinion, is much to be commended. There are periods in the life histories of many insects when they can be easily reached if we only know how, and where resort to some simple bit of field practice may prevent injury. A good example of this is seen in the practice of cutting close to the surface all shoots of blackberry about June 20 to prevent injury from the *Agrilus ruficollis*. All the eggs have been laid at that time, and the new shoots will be exempt, of course, while the larvæ cannot develop in those that have been cut down and will die. The whole matter seems so simple now, and yet it is less than two years ago that this was practiced almost simultaneously in New Jersey and Ohio.

"Preventing injury from the larvæ of *Melittia ceto* in late squashes by planting summer varieties upon which the eggs are laid and in which the larvæ are afterwards destroyed is another method which has been worth many hundreds of dollars to farmers on Long Island and in New Jersey.

But there is yet much to be done in this direction, and I am convinced that in the future "circumvention" will be practised in many cases where we now use poison. Farm practice, using this term in its widest sense to include the mechanical treatment of land, selection of fertilizers, date of planting and harvesting, rotation of crops, etc., will in time give us control of many injurious species which at present seem beyond our reach. It must be our aim to ascertain as far as possible the circumstances least favorable to the development and maintenance of the troublesome species, and then our attempt must be to produce just those conditions.

"We should, I think, whenever possible, lay great stress upon the importance of destroying crop remnants when they are no longer needed. For instance, cucurbit vines are usually left on the ground after all the crop is off, affording abundant opportunities for the maturing of *Anasa tristis*, the melon lice, and other pests. Removing them when no longer needed and destroying will save much trouble during the year following. Systematically burning potato vines as soon as the crop is harvested will prevent all

danger of injury from the potato-stalk weevil (*Trichobaris 3-notata*), and I might cite many other cases were it necessary. We should also set out the advantages of winter work against many kinds of insects in orchard, vineyard and garden, and the desirability of destroying by fire everything that comes under the head of rubbish. Especially against certain kinds of hemiptera this sort of work would prove effective, and fire, judiciously used, can be made a valuable friend. So, much of the pruning should be done at this season, where the character of the plant warrants it, and if the cuttings be burnt many ova of insects will be destroyed. But I am telling you old facts which you do not care to hear. My purpose was not to offer them as information, but to urge their more forcible presentation to the farmer, and to indicate that in my opinion the future development of our dealings with insects will be along this line. * * *

"On the whole, I may repeat, we have rather cause for congratulation than otherwise. Our favorite branch of scientific investigation has made continuous and healthy progress; we have firmly established the reason for our existence and have impressed the general public with a dawning of appreciation for the work we are doing. Our session here will, I doubt not, improve our standing, and will at all events be profitable to those taking part."

Professor Fernald discussed interstate entomological problems with particular reference to the gypsy moth and the attempts to get the work against this insect undertaken by the General Government. He referred also to the difficulties arising from the conflict of interests of different States.

The first paper on the list, "Notes on Insecticides," was read by Mr. C. L. Marlatt, in which he described at length a series of experiments that he had made in order to thoroughly test the various apparatus that had been designed for spraying with kerosene oil and water, the results of which were not entirely satisfactory. He then treated of various insecticides, viz., soaps, arsenate of lead, cyanide of potassium and arsenite of copper.

AFTERNOON SESSION—AUGUST 27, 1895.

A paper by Mr. H. E. Weed on "Some Experiments with the Knapsack Kerosene Attachment," was read in his absence by Mr. Davis. In it the writer set forth the advantages that are claimed for the use of this mechanical mixture of kerosene and water over the familiar kerosene emulsion. It was followed by a paper by Mr. Clarence M. Weed on "A Modification of the Kerosene Knapsack Sprayer," in which he reported a series of tests of the knapsack sprayer with kerosene attachment, showing that the principal machine now on the market is unreliable in its present form. The chief source of error appears to be due to the continual differences of level in the kerosene and water tanks. To avoid this a kerosene attachment had been made at the New Hampshire Experiment Station, and was exhibited, of the same height as the water reservoir and holding one-tenth as much. A stopcock with a single hole one thirty-second of an inch in diameter connected the kerosene reservoir with the pump. By this arrangement a fairly constant spray having nine per cent. of kerosene in it was obtained. The opinion was expressed that to get successful results we must abandon the idea of having a large range of variation in one combination of reservoirs—*i. e.*, in expecting to get either a five per cent. or a thirty per cent. emulsion by turning a stopcock at a less or greater angle. The author believed that the kerosene sprayer was capable of great improvements along the lines indicated, and thought it too great an advance in methods of insect warfare to be lightly abandoned.

The following communication on "Spraying Without a Pump," by Mr. J. M. Aldrich, was in the form of a letter to the Secretary, accompanying a working sample of the apparatus. The apparatus itself and the manner of working it were described by the

Secretary with the aid of blackboard illustrations. The following is an abstract of the letter :—The spraying device which was suggested by the author to the association last year was again presented to call attention to two changes in the machine from the first idea. First, it is necessary that the stream from the hydrant enter the lance within rather than beyond the entering point of the insecticide ; second, the Nixon nozzle is entirely inapplicable to this form of apparatus, for the reason that it chokes the flow so as to destroy the suction in the insecticide tube. No nozzle has yet been devised free from this objection, except a plain deflector tip. The author is aware that a deflector does not give so good a spray as can be obtained in other ways, and hopes yet to overcome this objection.

The spraying device consists of a sort of lance, forked at the base. One fork connects with a hose to a hydrant or water supply under pressure, and the other with a tube leading into the vessel containing the insecticide. Both forks are provided with stopcocks. The suction caused by the passage of the water through the lance induces a flow through the fork and hose leading from the insecticide.

To use the apparatus, attach to an ordinary lawn hose by the large coupling. Turn on the city water, and it will be at once perceived that there is a strong suction through the small or insecticide tube. Put the end of this in a pail of water or kerosene, and, in the case of the apparatus experimented with, sixteen per cent. of the total discharge comes through it, the stopcock being wide open. By partly turning off the stopcock the proportion of kerosene can be reduced at pleasure, and the percentage may be indicated by graduations on the back part of the stopcock.

For Paris green, make up a pailful at the rate of one pound to twenty-five gallons of water, and when drawn through the machine it will be diluted at the eight per cent. kerosene gauge mark to one pound to 150 gallons and thoroughly mixed.

The device was experimented with by the inventor with a water-pressure of seventy-five pounds, which was inferred to be an average for city water.

No claim to novelty for this device was made except in the application. The principle is the same as that in the "jet pump" used for draining out barges, cellars, etc.

If the instrument deserves any name, it is suggested that it be called the Idaho jet sprayer.

Discussion of the foregoing papers followed. Mr. Southwick had canvassed the question of spraying from hydrants in his work in Central Park, New York, but had found it impracticable on account of the insufficient pressure of the water and the small number of hydrants. He said he was devising a steam pump which he hoped would give greater satisfaction than any apparatus hitherto used.

Mr. Davis suggested that any apparatus dependent on a constant water supply, as of hydrants, would be more feasible in the West in connection with irrigation plants.

Mr. Howard remarked that a stream produced by a pressure of seventy-five pounds to the square inch, mentioned by Mr. Aldrich as obtained from his hydrants, was quite sufficient to kill insects, with the exception of scales, without the addition of oil.

Mr Lintner asked if the oil and water mixture referred to in the various apparatus described in the papers could be properly considered an emulsion.

Mr. Marlatt said that an oil emulsion was merely the breaking up of the oil into minute globules in the emulsifying agent,and that on this basis the water and oil mixture, as long as permanent, was as properly an emulsion as the kerosene and milk mixture. He referred also to the fact that emulsions are often made with solid ingredients, as powdered lime.

Mr. Southwick referred to a nozzle which had lately come under his observation, which effects the mixture of the insecticide element with water at the moment of spraying. He had not yet experimented with it.

Mr. Marlatt said that from the description Mr. Southwick undoubtedly had in mind the Gillmore nozzle (to which Mr. Southwick assented), and said that Mr. Gillmore was at the Department, and some very careful tests were made with this nozzle with various insecticide agents. The character of the nozzle and the practical objections to its use were then pointed out.

Mr. Forbush said he knew of a similar principle at one time employed by a fire apparatus company to mix a fire extinguisher with water at the moment of spraying.

Mr. Smith said it was very encouraging to see such decided interest taken in the manufacture and improvement of machinery for the application of insecticide mixtures. He was of the opinion that the origination of new devices and the work of perfecting old ones or overcoming mechanical difficulties may be safely left to manufacturers, whom he had always found very ready to adopt suggestions in the matter of the betterment of apparatus. In this connection he referred also to the adoption by the Climax Pump Company of an improvement in the kerosene knapsack sprayer suggested by Mr. Goff. His experience with the improved knapsack sprayer, he said, corresponded very closely with that detailed by Mr. Marlatt.

Mr. Marlatt, referring again to the device suggested by Mr. C. M. Weed, pointed out that while the arrangement of the kerosene and oil reservoirs suggested by this author would probably obviate several of the difficulties, still an important objection, arising from the oil escaping into the water chamber during the action of the pump or immediately thereafter, was not corrected by this means, although possibly rectified by the combination suggested by Mr. Goff in a communication in Garden and Forest of April 10, 1895.

Dr. John B. Smith read the following paper :

"Raupenleim" and "Dendrolene."

"Raupenleim" and "dendrolene" are both crude petroleum products of a butter-like consistency at ordinary temperatures and becoming only slightly softer at high temperatures. The raupenleim is a German product, very dark in colour, with a tarry odour and probably mixed with some tar preparation. The American product is brown in colour, almost without odour, and without foreign admixture to disguise its character or give it a specific smell. Raupenleim is largely used in Germany to protect trees from the attacks of certain insects and to prevent their being injured by stock or deer during the winter. The materials were tested comparatively for the purpose of preventing borers from attacking fruit trees, and if possible to prevent their issuance when already under the bark. Both materials can be readily applied with a paddle or trowel and distributed by means of a stiff brush so as to make a tolerably even coating. Experiments showed that it did not injure even young shoots where applied to the bark only; but where buds or growing tissue were covered it killed the buds and shoots by choking the stomata. A young tree set out in 1894 was covered from the surface of the ground to the buds without detracting from its vigour during the balance of the season. It was applied upon an orchard of pear trees infested by the sinuate pear borer and both materials prevented oviposition. The raupenleim absolutely prevented the issuance of all the beetles maturing under the bark. The dendrolene did the same where thoroughly applied. The raupenleim has a tendency to harden on the surface. This is a good thing where it is intended to prevent beetles from issuing from the trees, but a bad thing where it is intended to prevent insects from crawling up the trunk. The dendrolene becomes very soft at high temperatures without running. This prevents insects from crossing it; but where it is applied thin it does not always form a barrier to insects emerging through the bark. Its application is recommended as against the fruit bark-beetle (*Scolytus rugulosus*), which can not emerge through it when already in the tree, and can not enter the bark protected by a coating. It was also tested against peach borers, and both materials proved effective.

It was stated by the grower conducting the experiments that the dendrolene killed the borers that were in the tree when it was applied, while the raupenleim did not. This fact may have been accidental and is not to be expected under ordinary conditions. The material is recommended for application to fruit trees to prevent attacks of round and flat-headed borers, and also wherever it is desirable to prevent insects from ascending or descending the trunk. A broad band, put on thickly, is recommended against the codling moth, and, in cities, against the white-marked tussock moth and the bag worm. It is suggested that applied on trunks on which insects like the pear psylla hibernate it will destroy these insects by preventing their coming out in the spring.

The cost of the raupenleim, free on board in New York city is, for twenty five pounds, $3.75 ; fifty pounds, $6.75 ; one hundred pounds, $12.75 ; barrel, from 250 to 275 pounds net, about $25. Dendrolene is supplied free on board at six cents a pound in New Brunswick, N. J., in lots of twenty-five to fifty pounds, and at 5½ cents in lots of one hundred pounds and over. The material can be washed from the trunks of the trees if desired by a strong potash mixture, say one pound of potash in a gallon of water. As the substance is a mineral product, it does not become rancid.

In answer to a question as to the composition of the lime, Dr. Smith stated that it was chiefly, if not entirely, crude mineral oil.

Mr. Southwick read extracts from a letter from agents for an imported insect lime, which were very extravagant in statement.

Mr. Fernald said he had experimented with the lime against the spring canker-worm, in conjunction with other experiments with printer's ink, the latter applied on paper bands, and banding the trees also with cotton, two or more bands being placed on the same trunk. Very few worms passed over the cotton bands, considerable numbers over the ink bands and a few over the lime. The larvæ chiefly effected their passage over the latter on cool mornings, which indicates that very diverse effects may be expected in different climates. He thought that of the three substances experimented with the imported or raupenleim gave the best results.

Mr. Howard asked what period of the year was included in the five months during which the lime was on certain trees.

Mr. Smith replied that they were the five months immediately preceding the middle of July.

Mr. Lintner suggested that the lime be so thinned down that it could be sprayed, to facilitate application.

Mr. Smith stated that this thinning would be especially desirable for work against scale insects, but that even when considerably thinned it could not be sprayed through an ordinary spraying nozzle.

Mr. Forbush said he had not his notes with him and therefore could not give in detail his experience with lime, which had been very extensive. He had used the raupenleim and an American material, Menzel's brand. He had found considerable difference in imported material obtained in different years. Sometimes it had proved very unsatisfactory and he had discontinued its use for other methods which he deemed more advisable for his work. He said that some insects can cross the lime, but when it is warm, and especially on sunny days, it is a nearly perfect barrier. On cold days, and particularly in stormy, rainy weather, insects can pass it with comparative ease. On smooth bark it will run somewhat, and will also crack or break, especially on rough-barked trees. German authors, he stated, claim that no injury results to the trees from its application, and his own experience was confirmatory of this. The only injury he had noticed came from the scraping prior to the application of the lime or injury from the lime as a result from such scraping of the bark. On dusty streets the lime soon crusts over and may be crossed by insects, and pine needles adhering to it produce a similar result. It is claimed by some that limed trees are not frequented by birds, but this idea was not confirmed by his own experience. He had used various machines and various devices had been constructed by the commission for the application of the

lime. The necessity in cities or public parks of applying the lime at considerable heights on the trunks to prevent contact with it on the part of passers-by rendered many machines for its application impracticable for his purpose, and he had been compelled to employ chiefly paddles and trowels. European machines were found to be crude and somewhat unsatisfactory. He said that in Europe the lime was employed also as a coating for egg masses to prevent the escape of the larvæ. The objection to this was that such egg masses were very apt to be broken open by squirrels and the larvæ thus enabled to escape at the proper time. He thought lime would be of value, particularly against the canker-worm. He had found in certain instances that after lime had been exposed on trees during summer and winter the following spring it was still of a consistency to be of service.

Mr. Smith said that the dendrolene referred to in his paper is entirely without odour, whereas the European lime smells very strongly of tar. He was of the opinion that this odour was given to the European product to conceal its true composition.

Mr. Davis had tried wool bands with parallel experiments with raupenleim against canker-worms, and found the latter successful in every instance; but this could not be said of the wool bands. He had found lime impracticable against cut-worms, many of them crawling over it in the cool of the evening; and it had not proved entirely satisfactory against the peach borer, as the borers frequently emerged in spite of the coating of lime.

Mr. Smith said that this would be very probably the case if the application were made to the peach after the larvæ were in the tree, but that the application would be more successful if used to deter the moth from ovipositing.

Mr. Southwick said that in his experience he had found the tussock moth larvæ so numerous that they had been able to crawl over the lime on account of mere numbers.

Mr. Smith said this would not occur in the case of young larvæ.

Mr. Forbush said larvæ would bridge over any band when very numerous, and that such a result could only be prevented by visiting the bands and collecting at frequent intervals the larvæ accumulated beneath.

Mr. Smith said that the American product referred to in his paper was less affected by extremes of temperature than the European lime. He was convinced that in insect lime we have a valuable means of defence against many insects, but that there was room for considerable improvement at present.

Mr. Forbush said that while he had discontinued it for other reasons, he believed that there were great possibilities in the proper use of insect lime.

Mr. Fernald, referring to the Russian lime, said that all the material probably came originally from Germany.

Mr. Smith stated that the constituent elements of the lime very possibly came from the oil regions of Russia.

Mr. Marlatt said the Department of Agriculture had received samples of this raupenleim, and called attention to the very strong similarity between this substance and ordinary axle grease, both in odour and physical qualities, and suggested that the composition of the lime was probably very similar to that of axle grease. He said that in applications to trees as against scale insects, and wherever applications were more generally made than by mere banding, the after effect on the tree would probably be disastrous, although it might not develop for some months. Experiments with other oils on trees gave a strong probability in this direction.

Mr. Smith said the insect limes would very probably turn out to be material similar to axle grease. The dendrolene referred to by him was a Standard Oil Company's product, and would very likely appear under different names as coming from different houses, although all would obtain their supply from the Standard Oil Company. As applied to old bark, which had no vital function, subsequent injury need not be feared.

Mr. Howard referred to the press reports of the loss by a Kentucky orchardist of a thousand valuable peach trees from the application of linseed oil, with other ingredients, as a preventive to the borer. The recommendation which led to the application was charged to the Department of Agriculture, this charge proving, however, by the man's own admission, to be unfounded.

Mr. Davis remarked that a similar remedy had been recommended by the United States Pomologist to the fruit growers of Michigan.

Mr. Smith called attention to the necessity, in reporting results, of giving adequate explanations, instancing the danger of confusion in the use of the term "emulsion" arising from the different kerosene emulsion formulas used as a case in point.

Mr. Forbush gave further results obtained by the commission in the use of lime against the gypsy moth and against the tent caterpillar, all indicating the value of lime. He also described the method of clearing out underbrush as a means of starving out the larvæ.

Mr. Howard said the starving-out plan was the one principally relied on in the work against the nun moth in Austria. Trees of considerable size were banded with the insect lime to prevent the ascent of the larvæ, and all low-growing vegetation was then absolutely destroyed and the larvæ perished for want of food. He further said that there are certain species of plant lice which descend the trunks of trees in autumn and ascend again in spring, against which bands of lime could be used to advantage. This would be particularly the case with the species common upon the tulip tree.

Mr. Lintner, referring to the difficulty of preparing a good emulsion, suggested the advisability of someone's undertaking the preparation of the emulsion as a merchantable article, spreading its benefits to the general public, who were not sufficiently skilled or equipped to undertake its home manufacture.

Mr. Smith said that some patented insecticides very closely imitated the kerosene emulsion, but were more expensive than their cost of manufacture warranted; but he agreed with Dr. Lintner as to the desirability of having the standard emulsion on sale.

Mr. Howard said that where an appropriation was available the superintendents of parks might make the emulsion and distribute it free of charge, as had been done in New Haven.

Mr. Southwick read a paper entitled "A City Entomologist and Insecticides."

The paper was discussed briefly by Messrs Smith and Howard.

Mr. Smith, discussing the work of Scolytus, stated that they normally attack weakened or unhealthy trees, and that a vigorous tree would require very considerable work by Scolytus to seriously injure it.

Mr. Lintner said he understood from Mr. Davis that the trees were thus diseased and unhealthy.

Mr. Davis replied that some of the trees were thrifty and others lacked vigour.

Mr. Rolfs referred to the great numbers of Scolytus which followed the disastrous frost of last winter in Florida, causing great alarm among fruit growers. He said, however, that the trees attacked were such as were greatly injured by the frost and would probably have died anyway from the effects of the latter, and that the beetles were always present though rarely injuriously abundant.

Mr. Howard said that it is well known that in the absence of sickly trees Scolytus will attack healthy and vigorous trees, and that the present large numbers of Scolytus are therefore a constant menace.

Mr. Smith said he had been informed by Mr. Schwartz that the beetles will enter healthy, vigorous trees, but are unable to successfully propagate in them.

Mr. Lintner said that Professor Peck had found them attacking perfectly healthy spruces.

Mr. Smith, referring to the climbing cut-worms, said that he had been frequently called on to determine for correspondents moths described as having been bred from climbing larvæ. He had received several such from Mr. Slingerland. He questioned if they did not adapt themselves to differing conditions, sometimes assuming the climbing habit, while perhaps normally working on the ground.

Mr. Howard reported that the species *subjuncta* and *scandens* had been repeatedly sent in this year as climbing cut-worms.

Mr. Sirrine asked if all cut-worms did not climb as young larvæ, giving his experience with cabbage cut-worms as sustaining that view.

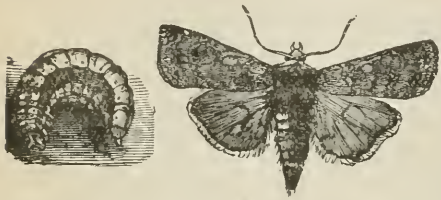

Fig. 34.

Mr. Smith said that this is the habit of *Carneades messoria* Fig. 34, on onions. In this connection he urged the value of personal observation to impress one with the true significance and importance of the working habits of insects. In illustration of this he referred to his having recently witnessed a grasshopper invasion in the west, which had brought to him a realization of the possibilities of this insect to which before he had been a stranger. He said also that the Hessian fly, commented on by Mr. Davis, had proved very much more numerous in New Jersey this year than in years recently passed.

Mr. Lintner said this fly was also very abundant in western New York.

Mr. Howard said this is distinctively a Hessian fly year, and that the division had recently issued a circular to facilitate answering the numerous inquiries received on the subject.

The following paper by Mr. Chittenden, was read by Mr. Sirrine:

Herbivorous Habits of Certain Dermestidæ.

The Dermestidæ, as is well known, feed chiefly upon dried animal substances. Certain species, however, are reported to have injured vegetable material, and a few recorded instances of damage of this character are cited. Until very recently the various species of household Dermestidæ had not been suspected of actually breeding in other than animal substances, but the experiments of the writer indicate that they subsist also on a vegetable diet.

The larva of *Attagenus piceus*, or black carpet beetle, was received in cereals from various sources, and was finally brought to the attention of the writer in such manner as to lead to a suspicion that it might feed, at least occasionally on vegetable substances. Adult insects were confined in a jar of flour and meal, and their progeny were found to thrive upon this material. This species was also found to breed in timothy seed, and incidental mention is made of serious injury to bolting cloth by it in a mill at Géorgetown, D. C. A brief review of the history of this insect in America, where it has been known since about 1806, is given, and instances of its reported occurrences in granaries are citied.

Trogoderma tarsale Melsh., a common museum pest, was found to infest flaxseed, castor beans, and cayenne pepper that had been on exhibition in the museum of the United States Department of Agriculture, the larva being reared from the egg deposited in these substances and the adults having been bred from other larvæ feeding on them.

An unknown and evidently recently imported species of Trogoderma was stated to be living in flaxseed, castor beans, and silk worm cocoons with the above-mentioned species, and in red-clover seed. This species is believed to have been introduced at Washington in the silkworm cocoons. It has been taken in New Mexico and will probably be found to have established itself elsewhere in the United States.

Anthrenus verbasci Linn, our most abundant insect cabinet pest, was reported as occurring in "middlings" and spoiled flour, and the fact mentioned that at the time of writing larvæ placed in flour were feeding upon it, from which it was judged that they would in due time reach the adult condition.

In conclusion it is stated that in the case of the Attagenus and Anthrenus, these insects were probably first attracted to granaries by the presence of weevils and other grain insects, and that the graminivorous habit is an acquired one. The presence of Trogoderma in oil seeds and red pepper, however, admits of no other explanation than that of the absence of animal food, and shows a wonderful adaptability to unnatural environment.

Mr. Howard said that the buffalo moth does not occur in Washington, its place being taken by *Attagenus piceus*. He asked for the experience of others as to the former insect to determine its southern extension. *A piceus*, he said, is not so troublesome as the buffalo moth but is yet a serious pest. In answer to a query from Mr. Davis he gave a brief description of the larvæ of the two species.

Mr. Lintner, referring to the popular designation of the insect as the "buffalo moth," said that he had often urged the discontinuance of the use of this misnomer and thought an effort should be made to secure popular acceptance of a more appropriate common name for this species. He thought it not so strange that Dermestidæ fed on vegetable material, since many species having an altogether animal feeding habit in the larval state are vegetable feeders as adults, instancing the feeding of larvæ of various species on woollens and other animal products, the adults of which feed on pollen.

Mr. Fernald discussed the use against these insects of inflammable and explosive insecticides in connection with its bearing on insurance policies and was inclined on this latter account, not to recommend them. He gave the method of controlling the pest followed with success by his wife, as follows: (1) Before bringing flowers into the house thoroughly shake them to dislodge the beetles. (2) Regularly collect and destroy the beetles which emerge and gather on the windows of the house during the months of March and April. (3) Carefully treat the carpets on the upper floors of the house, as the beetles commonly enter through the upper windows, and these carpets act as traps, getting the first and the bulk of the invasion.

Mr. Davis said his wife had been unsuccessful in the use of similar remedies.

Mr. Rolfs said that the work of the carpet beetle was much worse in the South than in the North, but he did not know the species. He used carbon bisulphide or cyanide gas, preferring the latter. If used with caution he thought neither of these substances dangerous, and their use was especially desirable in connection with herbariums.

Mr. Lintner said that he ordinarily recommended kerosene, which he thought more suitable than gasoline. Before laying new carpets all the grooves should be carefully filled with cement or plaster, and the carpets should be left loose at the borders to facilitate frequent investigation. The use of tarred paper was also advisable. He had found the following trap method valuable; Remove all woollens from rooms or closets and scatter about them bits of red flannel, which is a very attractive bait for the Anthrenus. The beetles thus attracted are afterwards collected and destroyed. Referring to Mr. Fernald's statement regarding the method of entrance of the beetles from flowers out of doors, he said that this is a common experience and that they commonly enter houses through the upper windows and appear first in the carpets of the upper rooms, thus making their reappearance after having been exterminated.

Mr. Fernald discussed the subjects of the relation of colour in woollens or carpets to infestation by the buffalo moth, and said that it had been carefully investigated by his former assistant, Mr. Lounsbury, as to the attractiveness both of particular colours and different dyes to the beetles. The information was sought from various sources, including factories for the manufacture of carpets and rugs. The conclusion arrived at was that colour is not an important factor—at least the beetles do not confine their attacks to

particular colours, though showing a preference for the greens. He thought it more likely that the preference exhibited by the beetles in certain cases was due rather to the mordant employed.

Mr. Howard said that the best remedy and the one which he now always advised, was to abandon the use of carpets altogether.

Mr. Smith had used the method suggested by Mr. Davis and had also employed gasoline. He had not found anything in insurance policies against the use of this or like substances in small quantities, but he was always careful to urge the greatest caution in the use of inflammable substances. He gave, by request, certain experiences which he had had with the use of bisulphide of carbon in the National Museum, a rather serious explosion having in one instance occurred from the ignition of this substance by the heat from a steam radiator, while there was another equally startling case of the ignition of the substance in a large box, resulting from a spark having been struck off from a nail in fastening down the lid of the box in which the bisulphide had been placed. In the latter case the box exploded and the negro laborer was either thrown a distance of some feet or had leaped a considerable length under the excitement of the moment.

Mr. Howard asked Mr. Taylor, a visitor present, who is engaged in the manufacture of bisulphide of carbon, if he knew of any cases of accident from the use of this substance.

Mr. Taylor replied that he knew of but one case of serious results, and that was where an explosion had resulted from a stroke of lightning. He was inclined to think that with ordinary precautions the danger was trifling. He said that the substance will ignite at 220° F.

Mr. Smith said that the radiator referred to by him was not nearly so hot as that.

WEDNESDAY MORNING—AUGUST 28th, 1895.

Mr. L. O. Howard read a very interesting paper on "Some Shade-tree Insects of Springfield and other New England Cities," in which he treated especially of the elm-leaf beetle (*Galerucella luteola*), and the Woolly Maple leaf Louse (*Pseudococcus aceris*), and traced their progress throughout the region referred to.

Mr. C. L. Marlatt followed with a paper on "The Elm-leaf Beetle in Washington," in which he described the methods pursued by the Division of Entomology to protect a grove of elm trees in the grounds of the Department of Agriculture from the ravages of this destructive insect.

Another paper descriptive of the history and injuries wrought by the same insect at Albany, N.Y., was read by Mr. J. A. Lintner, State Entomologist.

A long and interesting discussion followed in which most of the members present took part.

At the afternoon session Professor Fernald gave an extended account of the operations of the Gypsy Moth Commission in Massachusetts. (See 25th Annual Report, 1894, page 67, for a description of this insect, and the methods adopted to keep it in check.) In response to a request Mr. Kirkland, assistant entomologist to the Gypsy Moth Commission, gave a verbal report on the more recent experiments with insecticides conducted by the Commission. He said that no success had been had with insecticides until the arsenate of lead had been devised, and even this, at the rate of ten pounds to 150 gallons of water, effected the destruction of only about fifty per cent. of the larvæ. He described his examination of the alimentary canal of the larvæ, with a view to determining the probable action of the juices contained in various parts of the canal on insecticide substances. He had found the juices strongly alkaline, and of the substances which seemed most likely to be acted upon by an alkaline liquid he had considered the cyanides of different metals to be the most promising. The cyanides of lead, antimony, copper, zinc,

iron, manganese, mercury, etc., were considered. The cyanides of antimony and copper, on theoretical grounds, seemed to promise best. The cyanide of antimony was totally without effect at the rate of 10 pounds to 150 gallons of water. Cyanide of copper was fairly effective, but too expensive for practical employment, three pounds to 150 gallons being with this substance equivalent to one pound of Paris green to 150 gallons of water, or three or four pounds of arsenate of lead to 100 gallons. Even where no practical results seem to have been obtained, as in the above series of experiments, he pointed out the value of the negative results ; in that the very fact that the merits of these substances valuable for insecticides is better understood and limited. In connection with the various experiments with insecticides he had occasion repeatedly to emphasize the extreme vitality of the gypsy moth larva and its immunity to the action of poisons.

Mr. Riley discussed the gypsy moth question at considerable length. He said he had always been much interested in the gypsy moth work, and referred to the original conference called by the State Board of Agriculture of Massachusetts, giving an account of this meeting, and of the suggestions made by himself and others as to means of controlling the insect. These suggestions were necessarily based on experiences with our well known common insects having somewhat similar habits, and had no basis in any actual experience with the insect under discussion. He had recommended and believed that the use of the arsenites is one of the most practical and effective means of control. There can now be no doubt, however, that this insect is an exceptional one, and probably can not be controlled by means which are quite effective against other insects, enemies of our trees, having similar habits. Emphasizing the great damage which may be done by this insect, he was convinced that its control and destruction are not only extremely necessary to the State of Massachusetts, but are also of national importance. He had always been in favor of extermination rather than of attempting to limit and control, but he pointed out the very great difficulty of exterminating the species if the work is mainly directed toward the destruction of the eggs, referring in this connection to his early statement in this regard, in which the destruction of the eggs had not been deemed of prime importance He thought, however, that in this particular he had been too extreme. He pointed out the absolute futility of any efforts at extermination which did not promise complete results. All that he had said in criticism of the Commission had been relative to the operations prior to Professor Fernald's controlling connection with the work. He heartily appreciated the value of the present methods as detailed by Professor Fernald. He felt that if at the outset a supreme effort had been made, with the aid of a very large appropriation, complete extermination of the insect could have been accomplished. He gave a summary of some early work and his criticism of it. He was somewhat inclined to question whether we are now justified in working on the basis of extermination through a State commission, or whether it would not be better to encourage the efforts of private individuals wherever the insect occurred, as is the case with other insect pests. He complimented very highly, however, the present work of the Commission. In discussing the subject of parasites, which had been referred to by Mr. Fernald, he was not inclined to agree with the idea that the aim of the commissson at complete extermination detracted at all from the necessity of undertaking the importation of foreign parasites. He said that such introduction could be accomplished at comparatively slight expense and would aid just so much the object of the Commission, pointing out also the greater usefulness of European parasites over native ones if introduced without secondary parasites. This would be particularly evident if his idea of the greater value of the destruction of the larvæ rather than the eggs were conceded.

In illustration of the great weight and value of Professor Riley's ideas on this subject, Mr. Fernald referred in the most complimentary way to the value of his long years of labor in the field of economic entomology, which had resulted in a store of information used and appreciated by all the workers of the world at the present day. He gave some statistics of the injury capable of being done by the gypsy moth in the State of Massachusetts, basing his deductions on the value of farm products and the estimated value of forest and shade trees (Mr. Lintner interjecting in the latter connection that the Saratoga elms were insured by the State at $500 each). Taking the probable injury from

this moth as a basis, he pointed out that a comparatively trifling tax only would be necessary to raise a sum sufficient to control the pest, and was very strongly of the opinion that the work of the Commission should be upheld and continued.

Mr. Howard said he was familiar with the work of the Commission and had gone over the territory and examined the methods of procedure in detail somewhat recently, and was convinced that anyone, seeing the operations and the results already reached, would be impressed with the fact that the work is now being done in the best possible way and according to methods which are most likely to accomplish the ultimate extermination aimed at. He offered a resolution regarding the work of the Commission, which was subseqently acted upon by the Association.

Mr. Lintner said he had been one of the first called to inspect the work and the conditions of the work, and had been deeply impressed with the amount of exertion necessary and the difficulties of successfully prosecuting it. He also had been most favorably impressed with the value of the methods at present employed. Whether ultimate extermination would prevail or not was at present, of course, merely a matter of opinion, but he was convinced of the necessity of continuing the work on the basis of extermination rather than mere control.

The next paper was read by Mr. Lintner on the striped "Cottonwood Beetle" in which he drew attention to the threatened destruction of the basket-willow industry of Onondaga and some other counties of western New York, from the ravages of an insect which has long been known as the striped cottonwood beetle, *Lina scripta* Fabr., but which hitherto has not been regarded as injurious. After describing the insect and its habits, and giving an account of the willow industry and its commercial importance he related the methods which had been made use of to control the insect and especially drew attention to a mechanical contrivance, called a "bug catcher" which had proved very effective for the collection and destruction of the beetles.

Mr. Webster read a somewhat technical paper on the probable origin of the genus Diabrotica. This was followed by a paper by Mr. Hopkins of Morgantown, West Va

ON THE STUDY OF FOREST-TREE INSECTS.

The study of the insects affecting forest growth, from an economic standpoint, is in many respects a unique branch of economic entomology, which should in our opinion be designated by the term "forestry entomology."

The importance of advancement of knowledge in this particular branch of science may be inferred from some references to the character of insect injuries to forest growth; to estimates of the amount of damage and the annual pecuniary loss occasioned by such injuries; to the limited knowledge of this class of insects, and to the possibilities of preventing a large per cent. of the loss by the adoption of simple, practical methods of combating the pests.

Character of Injuries.

The injuries to forest growth may be separated into two classes, those affecting the living plants and those affecting the dead or dying plants. Of the former we have injuries to the foliage by leaf-eating, leaf-mining, sap-sucking, and gall-making insects; to the twigs and branches by sap-sucking, twig-mining, bark and wood boring insects; to the trunk by bark and wood-boring, and to the roots by wood-boring, bark-boring and sap-sucking species; the effect of the injuries thus caused upon the living plant being either destructive or detrimental to its growth or usefulness.

The injuries of a destructive character are those caused by insects which occur in sufficient numbers and make their attack in such a manner as to destroy or weaken the vitality of the tree sufficient to be the prmiary cause of its death.

The injuries of a detrimental character are those which are detrimental to the health, perfect growth, or future usefulness of the tree or its product, but do not cause its death.

Of the injuries affecting the dying and dead trees we find, as among those affecting the living, some which are of a destructive character, while others are simply detrimental. The destructive injuries are those caused by wood-boring insects, which render the wood worthless for any practical use to man. The detrimental injuries are those which produce defects in the wood and hasten the decay of the affected parts.

Character and Extent of Damage to Forests by Insects.

Few persons who have not given considerable thought to the subject realize the serious character of insect depradations upon our forests and forest products. This is evident from the fact that the subject is seldom discussed at the meetings of forestry associations and is rarely referred to by writers upon forestry economy in this country.

If we were to assert as our belief that the annual damage and loss occasioned by insects to owners of forest and forest products in the United States was greater than that caused to the same by fire, few persons, if any, would believe that it could be possible. Yet when we come to consider the varied losses resulting from insect depredation, both in a destructive and detrimental manner and in the general influence of their work upon the forest economy of the country, we believe that such an assertion would not be far from correct.

The pine and spruce killed by bark beetles over vast areas in New England and in the Southern States within the last few years has caused an enormous loss of valuable timber ; yet this is only a small portion of the damage to timber by insects. That caused in oak by the oak timber worms (*Lymexylon sericeum* and *Eupsalis minuta*), the Columbian timber beetle (*Corthylus columbianus*) and the carpenter moths of the family Cossidæ, to the chestnut by the chestnut timber worm (*Lymexylon sericeum*), and to the tulip and other kinds of timber by the Columbian timber beetle, all of which attack living trees, will equal that caused by many forest conflagrations. Then when we come to consider the damage to the wood of dying, dead and felled timber, and the work of destruction only begun by fire and completed by wood-boring species, it appears to us that the damage caused by insects is at least equal to that caused by fire.

There is also another feature of the question, and that is in reference to the effect of the detrimental and destructive ravages of forest insects upon the forestry economy of the country. Owing to the large amount of timber destroyed and rendered defective by insects, it is necessary for the manufacturers to cut over a larger area than would otherwise be necessary in order to supply the demand for the best grades of lumber and other timber products. According to a statement by Hon. J. Sterling Morton at the last meeting of the American Association of Agricultural Colleges and Experiment Stations, the area cut over every day in this country to supply the demand for forest products is 30,000 acres. From our observation in the lumber regions of West Virginia it would indicate that at least ten per cent. less timber might be cut each year for this purpose were it not for the detrimental ravages of insects upon the standing and felled timber. Therefore, in this item alone the annual loss to the country and to the manufacturer is enormous, for it must be remembered that a large per cent. of the defective lumber is manufactured and disposed of at a loss to the manufacturer, and is often the cause of serious loss to the consumer.

No accurate estimates of the pecuniary losses caused by forest insects can be made. Yet with the knowledge gained on the subject from recent investigations of the ravages of forest tree insects, from correspondence with lumber manufacturers upon the subject, and reference to the statistics of forest products, we feel justified in presenting some figures which will at least indicate the extent of the loss.

We would estimate the loss caused by bark beetles of the family Scolytidæ, which have caused the death of pine and spruce trees over vast areas within the last ten years,

at an average of $5,000,000 per year ; by bark and timber beetles of the Scolytidæ family causing defective wood in felled timber, $1,000,000, and by the same in timber injured by fires and other causes, $1,000,000 ; by the Columbian timber beetle to standing and living timbers, an average of $1,000,000 per year ; by the oak timber worms and the carpenter worms to the different species of oak, an average of $2,000,000 per year ; to chestnut timber by the chestnut timber worm, which is rendering one of the most valuable woods almost worthless, an average of $1,000,000 ; by wood borers of the family Cerambycidæ to standing timber injured by fire, $2,000,000 ; to felled timber and saw logs by the same kind of insect, $2,000,000 ; by other wood-infesting insects to standing and felled timber, $2,000,000 ; by foilage-infesting insects to living forest and shade trees, $3,000,000 ; by the white pine weevil, plant lice, scale insects, etc., to young forest growth, $1,000,000 ; by the powder-post beetles (Ptindæ) to forest products, such as seasoned handles, spokes, hoop-poles, building material, etc., $100,000, and by miscellaneous insects not included in the above estimates, $3,000,000—a total of $25,000,000 direct annual loss from insect ravages, which is without doubt a low estimate.

To the above could be added the loss to manufacturers in manufacturing and disposing of defective material, to consumers from the use of the same, and to the indirect loss to the country in the diminished forest area due to insect ravages ; all of which, could it be estimated in dollars and cents, would doubtless equal at least ten per cent. of the total value of the annual forest products of wood material in this country, or about $100,000,000 annually.

With Further Knowledge on the Subject Much of the Loss can be Prevented.

Probably one of the principal reasons why the economic study of forest insects has been neglected in this country is the prevalent belief that few, if any, practical methods can be found to prevent loss from their injuries. It is true the methods used to prevent loss from the attack of farm, garden, and fruit insects can not, as a rule, be successfully used against those affecting forest growth ; neither can many of the successful European methods of combating forest insects be adopted in this country. But there are simple, practical methods known which, if better understood by forest owners and manufacturers of forest products and properly applied by them, would prevent the annual loss of many millions of dollars' worth of timber.

Some of the results recently obtained and facts determined in the investigations now in progress in West Virginia in reference to the proper time to fell timber to prevent detrimental injury by insects, the utilization of defective material to the best advantage, and the introduction of predaceous and parasitic insects to prevent the undue increase of destructive species lead us to believe that many of the more serious troubles can be easily controlled when we learn more of the habits of the insects and the various conditions, favorable and unfavorable, for their development.

Additional Knowledge and More Special, Original Work Necessary.

Further original research and additional published knowledge are sadly needed in this branch of economic entomology. As compared with the knowledge of insects affecting other economic plants, scarcely anything is known of the life history and habits of even our commonest forest-tree insects. Consequently, the field for original work in forestry entomology is a broad one, rich in interesting material as well as in possibilities of important discoveries.

One of the most important aids toward advancement would be, in our opinion, carefully prepared monographs of the insects known to infest the different economic forest trees, on a similar plan to that adopted by Professor Forbes in his recently issued part of "A Monograph of insects injurious to Indian Corn."

Previous to the undertaking of work of this kind, however, further knowledge is necessary in reference to the food habits of the insects found upon or within the different host plants, and whether they are destructive, detrimental, beneficial, or neutral in their

economic relation to the host. This important information can be best and most reliably supplied by specialists who are studying the different families of insects, and by those who will make a study of the food habits and life history of certain classes of insects which infest forest growth, such as foliage-infesting, bark-infesting, and wood-infesting insects, etc., as special lines of research.

If specialists in these various lines will keep in mind the importance of noting the host relations of the species they collect or observe on forest growth, and will publish the knowledge thus obtained, together with lists of species taken on the various economic forest trees, they will contribute valuable service to the country in the rapid advancement of forestry entomology.

Mr. Webster read the following paper:

THE IMPORTATION AND REPRESSION OF DESTRUCTIVE INSECTS.

By F. M. Webster, Wooster, Ohio.

In the year 1795 my topic would have sounded remarkably visionary and illogical; not that it was not known that destructive insects were being brought into this country from England and Europe, but that there should be any united action to prevent such importations, or to suppress them after being introduced, would heve sounded unreasonable and unpractical. But, come to think of it, can we name a single imported insect that has been repressed, or, in fact, has been seriously impeded in its diffusion over the country, by any systematic obstacles placed in its way by the action of man? Is it not nearer the truth to say that we have, as a people, assisted this sort of immigrants, both in reaching this country and in getting inland as fast as possible after they had landed? Our entomologists have increased in numbers and efficiency to deal with these pests, but I do not know of a single one that we have prevented from coming to this country or stamped out after it had reached here.* That we have and are saving the country millions of dollars annually by our advice and experiments I freely admit, but that is only a temporary relief, and by no means a protection against future depredations and losses. Now, there must be something the matter somewhere, and if not with the entomologists, as I feel that it certainly is not, then wherein lies the obstacle? Entomologists do not make the laws, nor are we always able to get those properly enforced that we do have; but that does not settle the problem. For my own part, I have very little faith in State laws, even if they could be enacted, and have often asked myself the question whether or not it was possible for a republican government, composed of minor governments, possibly, as in our case, numbering nearly half a hundred to protect its people from the immense losses occasioned yearly by destructive insects whose place of nativity is known to be thousands of miles away and across wide stretches of ocean which they could never have crossed unaided.

At present we seem unable to deal with the problem intelligently and practically, even within our own borders. We can not, as a people, protect ourselves from each other, much less from countries who very naturally have less regard for us than we have for ourselves. It was with such feelings that I watched the diffusion of the San Jose scale, even after it had been located. Here was a simple problem in national economic entomology, and the question appeared to me to be composed of two propositions, viz.: Could we do anything with it? and if so, what would be the importance of the entomologist in this transaction? We have been steadily gaining strength during the last quarter of a century, and I was a little desirous of seeing how powerful we were getting to be, how much we could do to stop the spread of this pest, as well as to effect its extermination where it had already gained a foot-hold. True, we had no laws to sustain us; but if we could but show the necessity for them we would have accomplished much, for, while

*See appended note at the end of this paper.

the San Jose scale is the latest importation, it by no means follows that it will be the last. It is all right to study the biology of the insect, and this is really the first step to be taken, but the duty of the economic entomologist does not stop there by any means. The man who has been unfortunate enough to get the thing in his orchard wants to know all he can learn about it, but the one who is free of it would vastly more like to know how to keep free of it. Some of you are aware that I am not in the least in sympathy with the manner in which we have been dealing with this pest, or rather with those who have knowingly carelessly harbored it. I do not say this with a spirit of fault finding or criticism, but rather with the idea of improving upon the policy. I fully submit that it is not right to knowingly wreck the business of any nurseryman who is willing to do everything in his power to prevent distributing such a pest with his stock ; but it seems to me that we commit even a greater mistake and do a more unjust act when we say that such a pest is in a certain locality, thereby throwing the onus on both the innocent and the guilty. This appears to me to be the very worst sort of an injustice, and places a premium on dishonesty. We should either give the name of the proprietor or else make no public statement whatever, giving him notice that any attempt to send out infested trees or plants will result in a prompt exposure and public condemnation.

If I were to say that a member of this association was a murderer, it would reflect on the honour of all of us, and would serve to protect the guilty one from justice, provided there was such a one among us. Hereafter when we have to quarantine, let it be against individuals or firms and not against States or portions of States in which the innocent outnumber the guilty. We must use harsh and severe measures where such are necessary in order to be just to the deserving, but we have no right to make these deserving ones a partner in dishonesty with the unworthy and disreputable. To do this is but to place ourselves in a position where we are sure to be imposed upon by the latter and secure the merited distrust of the former. The people are coming to place some of their interests in our keeping, and if we would hold on to that confidence we must deal justly but firmly with those who threaten such interests, with the sole aim of profiting thereby. Even if entomologists were clothed with the right to enter into an agreement with nurserymen to keep the presence of a dangerous pest a secret from the public, which I strongly question, it is poor policy to do so. For a public servant to make private arrangements with those harboring public enemies is, generally speaking, a risky business and not usually conductive in elevation to the estimation of those whose esteem we can not well afford to ignore. There should be a discrimination between the deserving and the undeserving, but it should be extended and not promised, and even then with the understanding that it was entirely in the way of official assistance. If we follow the proper course, so as to merit the confidence of the people, the latter will be perfectly satisfied with the information that infected nurseries are under strict surveillance, and nothing infected will be allowed to go out ; but let there be a few more revelations of the actions of some of these, such as we have seen within the last year, and people will naturally begin to speculate as to whom we are assisting and whose interests we are protecting.

I mention these things because I believe we can improve upon the policy that some of us have been following, largely by force of circumstances. What I would urge is this: First. a uniform policy to be followed as closely as our surroundings render possible by all of us ; second, on the information of an infested nursery coming to us the proprietors are to be informed that no infested stock is to be sent out, and that they are to promptly go to work to stamp out the pest, and that any attempt to evade these rules will result in a prompt exposure. If it is known that their trade will not suffer if they choose to purchase their stock from uninfested localities until they have destroyed the pest on their own, most men will see at once that it is the least expensive way out of the trouble. I am satisfied that there is a method of procedure that will work the least hardship to the deserving, yet will compel the stubborn to keep infection confined to their own premises and stamp it out there as soon as possible. I believe that we hold the balance of power, so to speak, and need not barter our influence, but hold it to be sought for by those who wish to escape with the least trouble and loss If we are but just in our actions there will no trouble about the better class of nurseymen siding with us, and we

shall have no difficulty in indicating the dividing line that separates the honorable from the dishonorable, and it will avail nothing for a belligerent firm to close their grounds and books against inspection and then demand our proof of infection. The very lack of proof of non-infection will be sufficient to fasten suspicion upon them.

I have noticed that the services of entomologists have been quite in demand during the last year by nurseymen who were free of the San Jose scale, and the statements of such entomologists were used in the advertisements of these firms; and I think the influence of Dr. Lintner and myself has been felt by at least two nursery firms when it came to the question as to whether they could continue to impose on the public or not. Now, while, as I stated, we have no laws to sustain us, we have a strong public sentiment in our favour, quite sufficient to influence the honorable to favour our plans, and the others we can whip into line, so to speak, by working on their interests. While we have not come out of this contest just in the shape that I wish we had, we have certainly placed our profession on a better footing and shown that we have a power to do for right and justice; that we can help the deserving and at the same time deal firmly and judiciously with the undeserving and disreputable; and so long as we are faithful to our trust we shall be able not only to hold our influence but greatly increase the same.

I confidently look for considerable aid from nurseymen themselves in the matter of preventing the distributing of orchard pests. The most pushing and energetic are beginning to see that it will pay to spray their trees year after year in the nursery row with both insecticides and fungicides; that by so doing they will get a better growth and consequently a larger number of first-class trees that will bring a better return for use of their land and labour. Now, these are not likely to be so blind as not to see that to be able to warrant their stock free from insect and fungus enemies will give them a prestige, and they will thus guarantee every bundle of stock that is shipped from their grounds. When we reach this stage of advancement it will be a small matter to get a United States law that will make this a condition of acceptance for transportation by the railway and express companies.

In the past our advice and cautions have been more or less ignored, but I think if a nurseryman were about to import trees or bring them from California he would think of consulting the United States entomologist in regard to the risk he would run with respect to injurious insects. And there is little doubt that there will be much more caution exercised in future than there has been in the past, and the next new thing we get we shall be better prepared to exert our power and influence than we were in this case. I am satisfied that the San Jose scale can be stamped out where it has been introduced, at least between the Rocky and Alleghany mountains. East of this area it will have to be exterminated or else many nurseries will be compelled to suspend business for lack of customers, and they are not going to do this in the near future. We have done well this time, but we will do better in the future.

NOTE.—The fluted scale of the orange (*Icerya purchasi*), though it has been subjugated in California, at a saving of thousands, if not, indeed, millions, of dollars (and the importation of the natural enemies whereby this was accomplished was the greatest achievement ever attained in practical entomology), still it has yet to be exterminated. So of the gypsy moth (*Ocneria dispar*), introduced into Massachusetts by a lamentable piece of carelessness on the part of an entomologist many years ago, while it has been overcome in some localities, it has not been exterminated. I am free to confess that up to the time of presenting this paper I had very serious doubts as to the possibility of this ever being done; not because of any fault or neglect among those intrusted with the work, but because it appeared to me that they had attempted an impossibility. I have since spent a day in examining the work in all of its details, and believe that I saw not only what had been done, but also what yet remained to be accomplished; and that, too, with unprejudiced eyes and mind, and in company with one who clearly had no other motive than to show me every feature precisely as it existed, without magnifying, minifying or concealing anything. I now feel confident that the question of the extermination of this

pest in Massachusetts is simply one dependent upon the support in future given those in charge of the work; that with proper support financially this pest will be absolutely wiped out of existence in America, and that the achievement will be the greatest yet attained, and one of which we shall all feel proud, while it will redound to the credit of economic entomology all over the civilized world.

F. M. W.

Mr. Fernald asked if anyone was aware of wilful and malicious importations of injurious insects from Europe, referring in this connection to the report of the possible transportation of certain American insect pests in the opposite direction. He was himself aware of no such cases.

Mr. Smith said the only case known to him was the importation of the Ailanthus silkworm.

Mr. Sirrine, referring to Mr. Webster's communication, said that he had found about the 1st of July instances of the purchase of apple trees badly infested with living San Jose scale, which had supposedly been effectually treated before being sold and sent out.

Mr. Smith said that he was aware that these trees had been treated with gas during the winter, and described the methods which had been followed. In the examination made by himself he had found no living scales, but undoubtedly some living specimens had been left, and probably from these the trees had become re-stocked. He pointed out the necessity of examining every scale before it was possible safely to pronounce stock immune, and therefore the impracticability of giving any such indorsement to nurseries.

Mr. Riley emphasized the extreme difficulty and great liability to error on the part of entomologists should they follow the plan of pronouncing any particular nursery free from scale. In some cases circumstances may warrant such an indorsement, especially if there is reason to believe that the insect in question is recently introduced and therefore confined to a restricted area or single point of infestation, as seemed, indeed, to be the case in the first discovery of the San Jose scale in the east. In such cases it may not be necessary to give publicity to the point of infestation if proper measures are being taken to suppress the insect. It was on this basis that he acted in the case of the San Jose scale; but when an insect is known to be widely disseminated a full public statement of the extent of the infested locality is desirable.

Mr. Smith agreed with Mr. Riley as to the difficulty of pronouncing any nursery untainted, and had decided for himself not to give clean bills of health to any nurseries in future.

Mr. Southwick read a paper entitled "Economic Entonomological Work in the Parks of New York City."

Mr. Webster read a paper on the "Insects of the year in Ohio." The time available for the reading of papers having expired, the three following, whose authors were absent, were read by title only, viz.:—"On the Natural Conditions which Affect the Distribution and Abundance of Coccidæ," by T. D. A. Cockerell, Las Cruces, N. Mex.; "How shall we Improve our Collections?" by C. P. Gillette, Fort Collins, Colorado; and "Carbon Bisulphide for Crayfish," by H. E. Weed, Agricultural College, Miss.

The following resolution relative to the Gypsy Moth Commission, introduced by Mr. Howard, was now brought up and received the unanimous indorsement of the Association:

Resolved, That it is the sense of this Association that the present Gypsy Moth Commission is prosecuting its work in the most intelligent and praiseworthy manner, and that its hands should be upheld by the State authorities.

Mr. Lintner presented the following resolution, which was also unanimously adopted:

Resolved, That this Association has learned with deep regret of the intended discontinuance of *Insect Life* with the present number. In consideration of the unusual value of this publication, the eminent ability with which it has been conducted, the high appreciation in which it has been held by all of our entomologists and those in other countries, and the importance of the published investigations into the life history of insects, largely on their economic aspect, this Association earnestly requests of the Department of Agriculture that the resumption of the publication of this invaluable publication may be directed at no distant day.

The Committee on Nominations, consisting of Messrs. Lintner, Davis and Rolfs, proposed :

For *President*, C. H. FERNALD, of Amherst, Mass.
For *First Vice-President*, F. M. WEBSTER, of Wooster, Ohio.
For *Second Vice President*, HERBERT OSBORN, of Ames, Iowa.
For *Secretary*, C. L. MARLATT, of Washington, D. C.

On motion, the chair was instructed to cast the ballot of the Association for the gentlemen named, and they were declared duly elected.

On motion of Mr. Southwick, the reading of the minutes of the entire meeting was dispensed with, and on motion of the same gentleman a vote of thanks was tendered the President and Secretary of the Association in recognition of their services.

On motion of Mr. Howard, the local committee in charge of the meeting at Springfield was given a vote of thanks.

President-elect Fernald took the chair and briefly expressed his thanks for the honour conferred upon him.

The Association then adjourned.

WILLIAM H. EDWARDS.

Our readers will all, we are sure, be glad to receive the excellent portrait prefixed to this volume of the well-known and now venerable entomologist, Mr. W. H. EDWARDS, of Coalburgh, West Virginia. His life-long work has been the study of diurnal lepidoptera, and the results of that work are splendidly set forth in the beautifully illustrated volumes of his "Butterflies of North America." In April, 1868, the first part was issued, and at once commended itself to entomologists everywhere by the exquisite beauty and finish of the plates and their faithfulness to nature. In July, 1872, the first series, forming a large quarto volume with fifty plates, was completed. The second series, containing fifty-one plates, was begun in May, 1874, but not finished until November, 1884; the less frequent issue of the parts being more than compensated for by the increased value of both plates and letter press. When the work was begun, as Mr. Edwards stated in his preface, little or nothing was known of the eggs, larvæ, or chrysalids of any except the commonest butterflies, and accordingly his first volume illustrated only the perfect state. In 1870 he made the notable discovery that eggs could be satisfactorily obtained by confining the female butterfly of any species with the growing food-plant of its larva, and at once began the study of the life-histories of a number of species previously known only in the imago state. The results of these studies are admirably set forth in the letter press as well as in the plates of the second and third series; on these are accurately depicted eggs and larvæ in their different stages, as well as chrysalids and imagoes. Many wonderful discoveries have been made during these investigations, among the first being that of the seasonal trimorphism of *Papilio Ajax* and the dimorphism of *Grapta interrogationis* and of *G. comma*. The process of breeding was soon taken up by Mr. Edwards's friends and correspondents all over North America, and, aided by the general extension of railways over the continent, he was able to get eggs of butterflies from widely distant localities, and to follow them successfully through all their stages. Thanks to his efforts the reproach of ignorance of the preparatory states of our butterflies has been removed, and though much remains to be learnt, vast progress has already been made. The first part of the third series was issued in December, 1886, and in October last we had the pleasure of welcoming the sixteenth. Far from showing any decline from the author's high standard of excellence, this last issue may justly be regarded as the climax of good work, both on the part of the writer and the artist. All through Mr. Edwards has been fortunate in having his wishes so ably carried out by his artist-assistants—Mrs. Mary Peart, of Philadelphia, who has drawn most accurately nearly all the plates, and in order to do so satisfactorily has reared most of the caterpillars; and Mrs. Lydia Bowen who has so exquisitely performed the work of colouring. Many of the plates of the third series have been drawn by Mr. Edward A. Kellner, of Philadelphia.

In addition to the great work that we have just referred to, Mr. Edwards has contributed largely to the periodical literature of the science, especially to the proceedings and transactions of the American Entomological Society and to the *Canadian Entomologist.* His first contribution to its pages was published in the third number of the first volume, in 1868, and he has continued to favour it with articles of great value ever since, his last paper, in the September number of volume xxvii., being the one hundred and sixty-eighth which he has written for our journal.

Mr. Edwards was born on the 15th of March, 1822, and will soon complete his seventy-fourth year. That he may long be spared in health and prosperity to carry on his excellent work is the cordial wish of the writer and all his friends.—C. J. S. B.

BOOK NOTICES.

The Butterflies of North America, with coloured drawings and descriptions, by W. H. Edwards. Third series, part xvi. Houghton, Mifflin & Co., The Riverside Press, Cambridge, Mass.

Though nearly a twelvemonth has gone by since the preceding part was issued, we could well afford to wait with patience for another number, when our author rewards us with so much that is remarkably interesting as well as valuable regarding the life-histories of some hitherto little known butterflies.

The first plate, which as usual is exquisitely drawn and coloured, depicts the female of *Parnassius smintheus*, Doubl.Hew., and both sexes of the variety *Hermodur*, H. F. Edw., together with the egg, larva in all its stages, chrysalis, last segments of the male butterfly, and many highly magnified details. After giving a description of the various stages of the insect, the author relates many most interesting facts regarding the life and habits of the butterfly, which have taken expert observers in the States of Colorado, Montana and Washington no less than twenty years to accumulate! The account is concluded with a description of the formation of the extraordinary pouch or keel which is to be seen beneath the abdomen of the females of various species of Parnassius. That this should be formed by the male is one of those strange marvels that render the careful study of the lives of our butterflies so interesting and attractive.

The second plate depicts both sexes of *Satyrus Charon* and the male of its variety *Silvestris;* also the egg, the various stages of the larva, the chrysalis, and many details. The imago and the several preparatory stages are described, and a short but interesting account is given of the habits of the butterfly and the rearing of the larvæ.

On the remaining plate are figured the egg, three stages of the larva with details, and both sexes of the imago of the British Columbian species (*Chionobas gigas*), Butler. After describing the preparatory stages so far as known, the author relates the differences in appearance and habitat between this species and *Californica* and *Iduna*, which are frequently confused in collections. *Gigas* is shown to be confined, so far as is yet known, to Vancouver Island, where the male frequents the tops of the highest mountains, the female being usually found much lower down; *Iduna* inhabits the slopes of the evergreen red-wood forest in north-eastern California on the Pacific coast; and *Californica*, the hot arid regions of east Oregon, Washington and the semi-desert portion of north-east California. "*Gigas* is semi-Arctic, living amid the cold, dark fir forest; *Iduna* is temperate, living in the mild, dark red-wood forest; *Californica* is semi-tropical, living in open, dry, warm glades in the "bushland" on the border between the forest and the open plains. *Gigas* alights on bare rocks; *Iduna* on green twigs; *Californica* on dead or dry grass." But we must refer the reader to the book itself for all the interesting particulars regarding these strange butterflies.

The wonder to us is that so few entomologists subscribe to this magnificent work. The parts are issued at such long intervals that the cost is very light; those who have secured them know what a treasure they possess and how highly they prize it.—C. J. S B.

THE NATURAL HISTORY OF AQUATIC INSECTS, by Prof. L. C. Miall, F. R. S. London and New York, MacMillan & Co. (66 Fifth avenue, N. Y.; price, $1.75), pp. 395.

This interesting work is intended, as the author states, "to help those naturalists who take delight in observing the structure and habits of living animals," and also to revive an interest in the writings of some of the old zoologists who did notable work in their day, but who are now almost forgotten, namely, Lyonnet, Réaumur, Swammerdam and De Geer, of whose lives and work he gives a short account.

To any lover of nature who wishes to look into the lives and doings of living creatures, and to investigate their structure and appliances for carrying on the business of their lives, this book will prove a very great help as well as an unfailing pleasure, and it ought to lead many a reader to explore for himself the ponds and pools in his own neighborhood which teem with insect life. The different groups of insects that live in the water in their larval or perfect states, are treated of in turn—water beetles and the larvæ of many flies, the caterpillars of some moths, caddis worms, May flies, alder flies (Sialidæ), stone flies (Perlidæ), dragon flies, pond skaters, water boatmen, etc. The very names of these insects bring to mind what one cannot fail to have seen and watched and wondered over. To have many of these wonders explained and described, and to have the insects themselves depicted and the peculiarities of their structure made clear by excellent woodcuts, is what we owe to the author of this book, and we hope that many will turn to its pages with profit and delight. It is a handsome volume, with clear, large type and a number of very good illustrations.—C. J. S. B.

The Cambridge Natural History, Vol. V. Peripatus, by Adam Sedgwick, M.A., F. R S.C.; Myriapods, by F. G. Sinclair, M.A.; Insects, (Part 1) by David Sharp, M.A., F.R.S. London and New York, MacMillan & Co.

The possession of some such work as this is of primary importance to the student in any department of zoology, to enable him to obtain, and have at hand for reference, a general knowledge of the varied groups into which, for convenience of study and classification, the animal kingdom is divided. In every home that can afford the luxury of books it will also be found most valuable, affording a continual fund of instruction, and implanting in the children a spirit of inquiry, and of interest in the many wonders of nature. It is only about ten years since the publication, in six sumptuous quarto volumes, of the Standard Natural History, edited by Prof. Kingsley, and having as contributors many of the most eminent scientific men of America. To a certain extent their references and illustrations were more largely drawn from the fauna of our own continent, although a work of this general character must not be expected to be in any way restricted in its choice of examples of any group. Our knowledge of the animal kingdom is, however, so constantly being enlarged by the labours of an ever increasing and better equipped body of investigators, that the present work will be found to be considerably in advance of any previous publication. The editors are S. F. Harmer, M.A., Superintendent of the Cambridge University Museum of Zoology, and A. E. Shipley, M.A., University lecturer on the Morphology of Invertebrates. These names, and those of the authors of the various memoirs, are a guarantee as to the accuracy and completeness of the work, and of its fitness either for the private student or for the teacher of zoology. When finished it will consist of ten handsome large octavo volumes, which will form a desirable addition to any library.

Mr. Sedgwick's memoir on Peripatus indicates at once the marked advance that has been made in some directions of biological research. In the Standard Natural History, where it is placed as a sub-class—Malacopoda—of the insects, this curious genus occupies scarcely more than a page, for the knowledge of it was than very fragmentary. Mr. Sedgwick, whose studies of the genus have been very extended, and who has written previous monographs, gives a very interesting account not only of the outward appearance of this very peculiar creature, but also of its embryology, development and habits. There are numerous illustrations and a map showing the distribution, which extends through portions of South Africa, Australia, New Zealand, South and Central America and the West

Indies. Described by its discoverer, (Rev. L. Guilding), as a mollusc, from its slug-like form, this unique animal is now found to belong to the arthropods, although possessing features not belonging to other members of that division. Indeed it is said to "stand absolutely alone as a kind of half-way animal between the Arthropoda and the Annelida." As a very primitive type, exhibiting affinities to both groups, it possesses a special interest to zoologists. The species are few in number, and are of elongated slug-like shape, with from seventeen to thirty-four pairs of legs; subsisting upon animal food and shunning the light.

The Myriapoda are stated by Mr. Sinclair in his introduction, "not to have attracted much notice until comparatively recent times. Compared with insects they have been but little known. The reason of this is not hard to find. The Myriapods do not exercise so much direct influence on human affairs as do some other classes of animals; for instance, insects. They include no species which is of direct use to man, like the silk-worm or the cochineal insect, and they are of no use to him as food." To the farmer's crops, however, some species, known as wire-worms, (Iulus) do considerable damage, while many of the carnivorous species must, on the other hand, be of considerable assistance in destroying injurious insects. Myriapods are those elongate, many-footed creatures, lurking under rubbish and in dark places, which are usually called centipedes and millepedes Regarded with distrust on account of the venomous bite of some of the large tropical species, their appearance and habits of concealment produce in most people a decided aversion to more intimate acquaintance. The author, however, gives a very pleasing summary of their habits, and proves that a study of these creatures, as is true of all forms of life, however repellant to the ordinary observer, is far from being devoid of interest. Our popular names are not sustained on closer examination, for none of the species have nearly a thousand legs, and a large proportion have far less than one hundred. The number varies from nine pairs in the tiny Pauropus, to about one hundred and seventy pairs in some species of Notophilus. The Myriapods have many affinities to the insects, and have been classed with them by many authors. They differ from insects, as well as from the other classes of arthropods, in having true, jointed legs on the posterior segments of the body. Mr. Sinclair recognizes five orders, the species of which vary in length from the one twenty-fifth of an inch (Pauropus) to almost a foot, as in the tropical centipedes. He does not mention, however, perhaps because it is now extinct, the great centipede, described in the Japanese tale of My Lord Bag-of-Rice, which inhabited Mukade-yama (Centipede Mountain) on the shores of Lake Biwa, and which was over a mile long, with exactly one thousand feet on each side of its body. Some of the forms, as Glomeris, are quite short and stout; others, as Iulus, have long cylindrical bodies; while Notophilus and Geophilus have the body very thin and elongated.

Eighty pages are occupied by these interesting memoirs on Peripatus and the Myriapoda, and in the third chapter Dr. Sharp introduces the Insects, and continues their discussion throughout the remaining five hundred pages, in a style that proves him a master of the subject, and also of its presentation to his readers. Naturally, as an Entomological Society, we take a closer interest in this great class, into which are grouped an immense assemblage of small creatures, varying to a wonderful degree in structure and habits, yet having, amidst all this diversity, well-marked relations to one another. To use the author's opening words "Insects form by far the larger part of the land animals of the world; they outnumber in species all the other terrestrial animals together, while compared with the vertebrates, their numbers are simply enormous. * * * * The largest insects scarcely exceed in bulk a mouse or a wren, while the smallest are almost or quite imperceptible to the naked eye, and yet the larger part of the animal matter existing on the lands of the globe is in all probability locked up in the forms of insects. Taken as a whole they are the most successful of all the forms of terrestrial animals. In the waters of the globe the predominance of insect life disappears. In the smaller collections of water many insects find a home during a portion of their lives, and some few contrive to pass their whole existence in such places; but of larger bodies of water they invade merely the fringes, and they make only the feeblest attempt at existence in the ocean."

A not infrequent question is "What is an Insect?" and for the benefit of many who have not opportunity to study entomology, yet to whom some knowledge of the subject is important, it may be answered by the author's brief and clear definition of the class Insecta; or Insecta Hexapoda.

"Insects are small animals, having the body divided into three regions placed in longitudinal succession, head, thorax and abdomen: they take in air by means of tracheæ, a system of tubes distributed throughout the body, and opening externally by means of orifices placed at the sides of the body. They have six legs and a pair of antennæ; these latter are placed on the head, while the legs are attached to the thorax, or second of the three great body divisions; the abdomen has no true legs, but not infrequently has terminal appendages and, on the under surface, protuberances which serve as feet. Very frequently there are two pairs of wings, sometimes only one pair, in other cases none; the wings are always placed on the thorax. Insects are transversely segmented—that is to say, the body has the form of a succession of rings; but this condition is in many cases obscure; the number of these rings rarely, if ever, exceeds thirteen in addition to the head and to a terminal piece that sometimes exists. Insects usually change much in appearance in the course of their growth, the annulose or ringed condition being most evident in the early part of the individual's life. The legs are usually elongate and apparently jointed, but in the immature condition may be altogether absent, or very short; in the latter case the jointing is obscure. The number of jointed legs is always six."

The amplification of this definition and the exposition of the external and internal structure, and of the functions of the various organs, occupy two chapters. Referring to Parthenogenesis, or "the production of young without the concurrence of the male," which sometimes occurs, the remarkable fact is noted that in a few species of saw-flies, gall-flies and scale-insects no male is known, so that they must be considered as perpetually parthenogenetic. The next chapter gives a valuable summary of the embryology and metamorphoses. While the vast majority of insects are oviparous, the eggs deposited varying greatly in number, size and shape, a few species bring forth living young, as in the Aphididæ (green-fly or plant-lice), which thus multiply with extraordinary rapidity. A brief chapter follows on the classification, and it can readily be understood that diversity of opinion has existed, and may long continue, as to the most satisfactory arrangement of the vast hosts of insects. As some 250,000 species have already been described, and several times that number undoubtedly exist, any scheme of classification must, under our present knowledge, fail to adequately provide for the reception of every form. Dr. Sharp points out that owing to the present limited knowledge of the earlier stages of insects, the only complete system of classification yet possible must be based upon the structure of the adult forms. It is noted with pleasure that he does not consider it necessary to make so many orders or primary divisions as has been the tendency of recent authors. Instead of twenty, as recently proposed by Packard, he limits them, much to the advantage of the ordinary student, to nine, viz., Aptera, Orthoptera, Neuroptera, Hymenoptera, Coleoptera, Lepidoptera, Diptera, Thysanoptera, and Hemiptera.

The Aptera are designated as "small insects, with weak outer skin, destitute throughout life of wings or their rudiments, but with three pairs of legs; antennæ large or moderate in size." It is pointed out however that this definition does not clearly differentiate them from many of the young individuals of other orders, and that the order does not, as its name might indicate, include all wingless insects. Two sub-orders are present: Thysanura, with the abdomen composed of ten segments, and Collembola, of not more than six. The study of these insects is attended with more than ordinary difficulty, as their habits and fragile structure make them troublesome to collect and preserve. Campodea, supposed by many authors to represent one of the most primitive types of insect, and therefore of unusual interest, is said to be "so extremely delicate that it is difficult to pick it up, even with a camel's hair brush, without breaking it." The Collembola are the "Spring-tails," two of the three families having the abdomen provided with a leaping apparatus which enables them to jump about in a very vigorous

and erratic way. The Aptera are supposed to feed upon vegetable and animal refuse, and can endure both heat and cold, but require moisture, so that they occur most abundantly in cellars, under rubbish, in mosses, and other damp situations.

The Orthoptera form one of the most important orders of insects, both as regards the diversity of structure exhibited, the great size of many species, and the enormous devastation often wrought by their innumerable swarms. Dr. Sharp occupies nearly one hundred and fifty pages with his synopsis of the order, and his admirably written and illustrated account of the various groups should awaken, in all who are fortunate enough to read it, a lively interest in the insect world. He estimates that the order contains, at the lowest figure, 10,000 species, and treats it as composed of eight families. Of these the first is the Forficulidæ, or earwigs; elongate insects, having the abdomen terminated by a pair of clasper-like instruments, often greatly developed. Many of the forms are wingless, and those provided with wings are able to completely fold them up and tuck them under short wing covers, so that they have considerable resemblance to some beetles of the family Staphylinidæ. In Canada earwigs are poorly represented, and the one little species of Labia found in Ontario is but rarely met with. The family Hemimeridæ contains a few small, wingless, blind insects from equatorial Africa, interesting as occurring on small mammals either as parasites or commensals. The Blattidæ, or cockroaches, are both destructive and unpleasant creatures, although some forms are brightly coloured. Canada is not much troubled with these creatures, although a few disagreeable species have been introduced, but in warmer climates they are often veritable plagues. The Mantidæ, or praying insects, are wanting in our fauna, but in tropical and sub-tropical regions the species are numerous and their bodies are often strangely developed; sometimes by leaf-like expansions, serving to make them inconspicuous among the foliage in which they lurk. These developments of structure are even more marked in the Phasmidæ—stick and leaf insects—as shown by the figures of various genera.

The family Acridiidæ contains those very prolific and voracious vegetarians, the locusts and grasshoppers. These breed so rapidly and appear in such enormous swarms as to make less incredible, than it might at first appear, the author's statement, previously quoted, as to the relative bulk of insects and other terrestrial animals. The migratory locusts at times destroy all vegetation over large areas, and may thus produce famine and disease. As Dr. Sharp says, "It is difficult for those who have not witnessed a serious invasion to realize the magnitude of the event. Large swarms consist of an almost incalculable number of individuals. A writer in *Nature* states that a flight of locusts that passed over the Red Sea in November, 1889, was 2,000 square miles in extent, and he estimates its weight at 42,850 millions of tons, each locust weighing one-sixteenth of an ounce. A second similar, perhaps even larger, flight was seen passing in the same direction the next day." The Locustidæ, or green grasshoppers, are more arboreal in their habits, and often have the wings of a very leaf-like appearance. They are also more musical, and capable of strong and sustained performances. The well known American Katydids belong to this family. The last family, Gryllidæ, contains the crickets, whose concerts enliven the summer evenings. The fossorial, or mole crickets, have the front legs most admirably adapted for burrowing.

The treatment of the Neuroptera occupies an equal space and is no less interesting. The first family, Mallophaga, contains the biting or bird lice, so troublesome to birds and mammals. The Termitidæ, or white ants, are one of the most wonderful of all the groups of insects, and the individuals are strangely modified to fit them for their duties in the communities of which they are members. A table is given which shows that as many as fifteen distinct forms may occur (as in *Termes lucifugus*), and many of these may co-exist in the community, while others are only produced as necessity demands. The African species are the most remarkable, *T. bellicosus* forming solid mounds as much as twenty feet high. To sustain the population of these immense colonies, the queen becomes a marvellous egg-producing machine. "Twenty or thirty thousand times the bulk of a labourer," she is unceasingly fed by a band of workers, and as unceasingly gives forth eggs, to the number even of "eighty thousand and upward in one day of twenty-four

hours." To the Neuroptera belong also the ant-lions, dragon-flies and other well known insects. A large proportion are aquatic in their earlier stages, and most interesting in their habits, either as residents of the water or the air.

The last one hundred pages of Dr. Sharp's charming portrayal of the insect world is devoted to a portion of the Hymenoptera, the species of which are estimated at 250,000. This order contains, among its almost inexhaustible forms, those which are of exceptional interest, from the intelligence which governs their actions. Dr. Sharp has called attention to an error which has occurred through hasty writing of the explanation of the anatomy of *Sphex chrysis* (page 490, Fig. 333), where the letter *f* is called a division of the metanotum, whereas it really belongs to the mesonotum. This error will be corrected in the portion dealing with the Aculeata The present volume only treats of the Sessiliventres, those in which the abdomen is broadly and closely joined to the thorax, and the parasitic families of the Petiolata, in which the abdomen is attached by a petiole, or stalk, often remarkably slender and prolonged. The first division includes the sawflies, of which the caterpillar-like larvæ are so injurious to vegetation, and the horntails, whose larvæ bore in the trunks of trees. The parasitic families exhibit much more variety of structure, and the species, even in our northern fauna, are exceedingly numerous. They vary in size; some Pimplids measuring several inches from the head to the tip of the very long ovipositor, while among the Proctotrypids and Chalcids are forms almost invisible to the naked eye. Dr. Sharp clearly tabulates the conditions under which the early life of such parasites is passed.

"1. The egg may be laid outside a larva, and the embryonic and larval developments may both be passed on the exterior.

2. The egg may be laid and the embryonic development passed through, outside the host, but the parasite on hatching may enter the host, so that the post-embryonic development is passed in the lymph of the host.

3. The egg may be laid inside the host, both embryonic and post-embryonic developments being gone through in the fluids of the host.

4. The egg may be laid inside another egg, the embryonic and post-embryonic developments being passed therein."

A large section of the Cynipidæ are not parasitic, but subsist upon plant tissues, producing swellings and distortions, known as galls, in which the larvæ live and develop. Among the illustrations of the hymenoptera are excellent figures of four insects occurring in Ontario and other portions of Canada, viz., *Oryssus Sayi*, *Tremex Columba*, *Thalessa lunator* and *Pelecinus polyturator*, the last three being quite common insects. The illustrations throughout the volume, 371 in all, are both accurate and artistic, and many have been specially drawn for the work. The paper and press work are of the best, and the result is a very handsome volume. The appearance of the next volume, completing this most valuable and enjoyable account of the insects, will be eagerly awaited.

W. Hague Harrington.

Rambles in Alpine Valleys, by J. W. Tutt, F.E.S.; 208 pages, five plates London: Swan, Sonnenschien & Co.

The Editor of *The Entomologists' Record and Journal of Variation* has added another to his popular books on the beauties of nature. This time he takes the reader abroad to the lovely scenery of Switzerland on the Italian slopes of Mont Blanc, where he wanders for the most part out of the beaten track of the ordinary tourist. Much of the volume is filled with charming pen-pictures of the infinite variety of grandeur and beauty to be found among the lofty mountain tops, the towering crags, the densely wooded ravines and the dashing torrents of this secluded Alpine region. The eye of the naturalist does not fail to observe the marvellous variety of animal and vegetable life that is to be found in this limited area; and the author describes many a plant and flower, and especially the gay butterflies and pretty moths with which the region

abounds. Some of the most interesting passages are those that deal with the phenomena of variation caused by environment, the results of the glacial epoch in the distribution of species, the effect of altitude on plants and insects, the evolution of the genus *Colias*, the production of colours, the causes of hybernation, and other topics which arise from time to time as the author rambles through the valleys or climbs the Alpine hills. The perusal of such a book as this must help the reader to see and observe, and lead him on to think out for himself the causes and the objects of the life that everywhere surrounds him.—C. J. S. B.

A Manual for the Study of Insects, by John Henry Comstock and Anna Botsford Comstock; Ithaca, N.Y. Comstock Publishing Co., 1895.

This is a work of 700 pages, profusely illustrated. A table of the classes of the Arthropoda is given, followed by a short characterization of the Crustacea. Thirty-three pages are devoted to the Arachnida, and a table is given for separating the principal families of the Araneida. The Myriapoda are briefly referred to, and chapter iii. begins the discussion of the true insects (Hexapoda). Nineteen orders are recognized, and a careful table is given for their practical determination.

In the remainder of the work, 618 pp., the several orders are treated with tables carrying the student to the families, each illustrated by typical common species, of which brief accounts are given.

In the lepidoptera, diptera and hymenoptera, the uniform system of nomenclature of the wing veins discussed by Prof. Comstock in "Evolution and Taxonomy" is applied throughout the orders. As stated in the preface, but slight changes are made from the usual classification of the families, except in the lepidoptera where the system proposed in "Evolution and Taxonomy" is adopted with slight changes. This is remarkably like Dr. T. A. Chapman's classification from pupal characters and the present writer's one on larval characters. All three agree in breaking up the old groups Zygænidæ and Bombyces, and the several members are referred to essentially the same places. The work affords for the first time a means for teacher as well as student to determine the family of any North American insect, for here synoptic tables replace the vague characterization so generally in vogue in zoology. To bring the tables down to species, as is done so satisfactorily in botany, as the author remarks, would make the work of enormous length, not to mention the fact that the present state of our knowledge of insects does not warrant such an undertaking. The work seems a very valuable and timely one.—Harrison G. Dyar.

We wish to add to the foregoing notice our hearty congratulations to Prof. Comstock and his talented wife upon the completion of their excellent work, and our tribute of praise for the thoroughly admirable manner in which they have performed it. It is now a little more than six years since we noticed in these pages the first part of this work, which consisted of 234 pages and 200 wood cuts; we then stated that "judging from the portion before us we have no hesitation in saying that the complete work will be a most valuable and admirable manual of entomology; in clearness and simplicity of style, in excellence of illustration and in arrangement of matter it leaves nothing to be desired." This prediction has been most completely fulfilled, the volume before us being, in several respects, even an improvement upon the original publication. The new illustrations are more artistic, and the diagrams of wing-venation and details are clear and accurate; the synoptic tables will afford any painstaking student satisfactory means of classifying into families any specimens that he collects, while the letter-press and figures will enable him to determine a large number of species. We heartily commend the work to all who are beginning to study entomology, and we can assure others, who have made some progress in the science, that they will find in it a vast deal of help and information that will prove of the utmost value. We may add that the illustrations consist of 800 wood cuts and six beautiful full-page plates, the one forming the frontispiece being coloured. The price of the work is so reasonable that it is within the reach of all.—C. J. S. B.

CANADIAN SPIDERS, by J. H. Emerton. Transactions of the Connecticut Academy, Vol. IX., July, 1894. Thirty pp., four plates.

This interesting and valuable paper treats of spiders collected in various parts of Canada from the Rocky Mountains to the Gulf of St. Lawrence. The author states at the outset that the species differ little from those of the New England States. "Out of sixty-one species, from Labrador to Manitoba, fifty-six species live in New England; and twenty-seven out of forty-eight species from the Rocky Mountains. Of the latter no less than forty of the species mentioned were collected by Mr. Bean at Laggan, and of these sixteen are described as new to science. Mr. Tyrrell, of the Geological Survey of Canada, supplied other species from the Rocky Mountain Region, Alberta Territory and Ottawa, and other collectors from the various localities mentioned in the paper. The plates illustrating the new species are admirably drawn by the author, the excellence of whose work in scientific illustration has long been well known and highly appreciated.—C. J. S. B.

REPORT OF OBSERVATIONS OF INJURIOUS INSECTS AND COMMON FARM PESTS, DURING THE YEAR 1894, with Methods of Prevention and Remedy. Eighteenth Report. By ELEANOR A. ORMEROD, F. R. Met. Soc. etc., etc., London; Simpkin, Marshall, Hamilton, Kent & Co, Limited, 1895, pp. 122, lxii, plate.

In this the author has given us another of her most excellent annual reports, if anything, better than those that have preceded it. There are twenty-nine species, besides the two groups, Iulidæ and Vespidæ, fully treated in the report which is illustrated by forty five figures and one excellent plate, the latter devoted to the Stem Eelworm, *Tylenchus devastatrix*, in connection with its recent discovery as injurious to hops. We congratulate the author on being able to give us so much information on Eelworms, Warble Fly and carabid enemies of the strawberry. In fact she has, throughout her report strictly adhered to the plan expressed in the preface, viz., "not to enter again on such of our common infestations as have been repeatedly noticed in my preceding reports, excepting where there was some new information to be given, or (sometimes) needed." This renders the report of unusual value. To do the publication justice is simply out of the question in an ordinary book notice, but suffice it to say that it is in every way a credit to its author.

The writer well remembers an evening spent with the late Frazer S. Crawford, at his suburban home near Adelaide, South Australia. We had been discussing entomology and entomologists, when he made a remark something like this. "Miss Ormerod is a noble woman and is giving both her life and her wealth to the agricultural interests of England, and I cannot understand why she should not be better appreciated by Englishmen." The sentiment will be echoed by American entomologists, but I fear in our hurry and bustle, we forget to drop an occasional word of encouragement and appreciation, such as we ourselves would gladly receive. Working almost alone, and comparatively unaided, in a labour of love not always appreciated, it seems to me that words of encouragement from her colleagues, both in America and out of it, are but matters of justice. Other reports on economic entomology there are, and they come officially from the Board of Agriculture of England, but the writer has searched through them in vain for tokens of originality or just credit for the information contained in them.—F. M. W.

OBITUARY.

CHARLES VALENTINE RILEY.*

The career of this distinguished naturalist, so suddenly closed while in good health, and with apparently many years of usefulness before him, was a remarkable one. Biologist, artist, editor and public official, the story of his struggles and successes, tinged as it is with romance, is one full of interest. Beginning life in America as a poor lad on an

*The following memoir of our lamented friend, Professor Riley, contributed to a recent number of "Science," by Professor A. S. Packard, is so excellent and complete that we prefer to give it in full rather than attempt to prepare another which would not be so satisfactory.—ED.

Illinois farm, he rose by his own exertions to distinction, and to become one of our most useful citizens in science, both pure and applied. His nature was a many-sided one, and his success in life was due to sheer will-power, unusual executive force, critical judgment, untiring industry, skill with pencil and pen, and a laudable ambition, united with an intense love of nature and of science for its own sake. This rare combination of varied qualities, of which he made the most, rendered him during the thirty years of his active life widely known as a public official, as a scientific investigator, while of economic entomologists he was *facile princeps.*

Charles Valentine Riley was born at Chelsea, London, September 18, 1843. His boyhood was spent at Walton-on-Thames, where he made the acquaintance of the late W. C. Hewitson, author of a work on butterflies, which undoubtedly developed his love for insects. At the age of eleven he went to school for three years at Dieppe, afterwards studying at Bonn-on-the-Rhine. At both schools he carried off the first prizes for drawing, making finished sketches of butterflies, thus showing his early bent for natural history, and his teacher at Bonn urged him to study art at Paris. But it is said that family circumstances, though rather, perhaps, a restless disposition, led him to abandon the old country, and at the age of seventeen he had immigrated to Illinois, and settled on a farm about fifty miles from Chicago. When about twenty-one he removed to Chicago, where he became a reporter and editor of the entomological department of the *Prairie Farmer.*

Near the close of the war, in 1864, he enlisted as a private in the 134th Illinois regiment, serving for six months, when he returned to his editorial office.

He also enjoyed for several years the close friendship of B. D. Walsh, one of our most thorough and philosophic entomologists, with whom he edited the *American Entomologist.* His industry and versatility as well as his zeal as an entomologist, made him widely known and popular, and gave him such prestige that it resulted in his appointment in 1868 as State Entomologist of Missouri. From that time until 1877, when he left St. Louis to live in Washington, he issued a series of nine annual reports on injurious insects, which showed remarkable powers of observation both of structure and habits, great skill in drawing and especially ingenious and thoroughly practical devices and means of destroying the pests. The reports were models and will never become stale. Darwin wrote in 1871: "There is a vast number of facts and generalizations of value to me, and I am struck with admiration at your power of observation. The discussion on mimetic insects seems to me particularly good and original." In reviewing the ninth and last of these reports, published in 1876, the *Entomologists' Monthly Magazine* of London, remarked: "The author, in giving full scope to his keen powers of observation, minuteness of detail, and the skill with which he uses his pencil, and at the same time in showing a regard for that scientific accuracy—unfortunately too often neglected in works on economic natural history—maintains his right to be termed the foremost economic entomologist of the day." It goes without saying that this prestige existed to the end of his life, his practical applications of remedies and inventions of apparatus giving him a world wide reputation. In token of his suggestion of reviving the vines injured by the Phylloxera by the importation of the American stock, he received a gold medal from the French Government, and he afterwards received the cross of the Legion d'Honneur in connection with the exhibit of the U. S. Department of Agriculture at the Paris Exposition of 1880.

The widespread ravages of the Rocky Mountain locust from 1873 to 1877 had occasioned such immense losses in several States and Territories that national aid was invoked to avert the evil. The late Dr. F. V. Hayden, then in charge of the U. S. Geographical and Geological Survey of the Territories, with his characteristic energy and sagacity, initiated researches on the locust in the Territories. He sent Dr. P. R. Uhler to Colorado in the summer of 1875, and also attached the present writer to the Survey who spent over two months in entomological work in the same year in Colorado, Wyoming and Utah, publishing the results in Hayden's Ninth Report. Mr. Walsh had made important suggestions as to the birthplace and migrations of the insect. Meanwhile Riley had

since 1874 made very detailed studies on the migration and breeding habits and means of destruction of this locust (published in his Missouri State Report for 1876 and 1877). Dr. Cyrus Thomas had also been attached to Hayden's Survey, and published a monograph on the locust family, *Acrididæ*. As the result of this combined work Congress created the United States Entomological Commission, attaching to it Dr. Hayden's Survey, and the Secretary of the Interior appointed Charles V. Riley, A. S. Packard and Cyrus Thomas members of the Commission. Dr. Riley was appointed chief, and it was mainly owing to his executive ability, business sagacity, experience in official life, together with his scientific knowledge and practical inventive turn of mind in devising remedies, or selecting those invented by others, that the work of the Commission was so popular and successful during the five years of its existence. Meanwhile in 1878 while the report of the Commission was being printed, Riley accepted the position of Entomologist to the U. S. Department of Agriculture, and during the season of 1879 and 1880 he investigated the cotton insects, but owing to the lack of harmony in the Department, he resigned, Prof. J. H. Comstock being appointed, and ably filling the position. Congress meanwhile transferred the cotton-worm investigation to the Entomological Commission. Riley was reappointed to the position of U. S. Entomologist in June, 1881. His successor, Mr. L. O. Howard, has stated how efficient, broad and thorough was his administration of this office: "The present efficient organization of the Division of Entomology was his own original conception, and he is responsible for its plan down to the smallest detail. It is unquestionably the foremost organization of its kind at present in existence." Again he writes: "Professor Riley's work in the organization of the Division of Entomology has unquestionably advanced the entire Department of which it is a part, for it is generally conceded that this division has led in most matters where efficiency, discipline and system were needed. Its plan and discipline have been cited by one of the heads of the Department as worthy of imitation by all, and your own honored Westwood, in expressing, in 1883, his admiration of Riley's work, said: 'I am sure it must have had a great share in inducing the activity in entomological work in America, which is putting to the blush the entomologists of Europe.'"

Indeed, so efficient, methodical and painstaking was Riley in whatever he undertook to do that had he been promoted to the position of Commissioner of Agriculture he would have been head and shoulders above any incumbent of that office, and, it is safe to say, would have administered its affairs with practical results far more valuable than those attained by any other Commissioner, as such an office should have been entrusted to a person who had had a scientific education, and not given as a reward for political service. As it is, he was the leader, says Mr. Howard, in many important innovations in the work of the department. His division published the first bulletin, and in *Insect Life* began the system of periodical bulletins, which has since been adopted for the other divisions of the Agricultural Department. He also took a large share in founding the Division of Economic Ornithology, Silk Culture and Vegetable pathology, the first two being placed for some time under his charge. In an address, says Howard, before the National Agricultural Congress, delivered in 1879, in which he outlined the ideal Department of Agriculture, Professor Riley foreshadowed many important reforms which have since become accomplished facts, and suggested the important legislation, since brought about, of the establishment of State Experiment Stations under the general government.

His practical, inventive genius was exhibited in his various means of exterminating locusts, in the use of kerosene oil emulsified with milk or soap, and in his invention and perfection—in which he was essentially aided by the late Dr. W. S. Barnard, who had special charge of the subject of mechanical appliances and remedies while connected with the Entomological Commission and the Agricultural Department, and whose "assistance was fertile from the first," as stated by Riley in his report—of the "cyclone" or "eddy-chamber" or Riley system of nozzles, which, in one form or another, are now in general use in the spraying of insecticide or fungicide liquids.

Although the idea of introducing foreign insect parasites or carnivorous enemies of our imported pests had been suggested by others, Riley, with the resources of his division

at hand, accomplished more than any one else in making it a success. We will let Mr. Howard tell the story of his success, with the efficient aid of Mr. Albert Koebele, in introducing the Australian ladybird to fight the fluted scale:

"One other trait which we have not mentioned is his *persistency in overcoming obstacles*. Nothing daunts him, and the more difficult an end is to attain, so much the more energy and perseverance does he put in its pursuit. A recent instance of this quality we may cite: The fluted scale (*Icerya purchasi* Maskell) has done immense injury to citrus fruit in southern California of late years. Ascertaining that it is kept in check by natural enemies in its native home, Australia, Dr. Riley foresaw the importance of endeavoring to introduce these enemies. Not only did Congress refuse to appropriate money for the purpose, but it refused to do away with a clause in the Appropriation Bill restricting all expenditures to the United States. In this state of affairs most men would have given up the fight; but Dr. Riley, after great trouble, succeeded in accomplishing his end by inducing the Secretary of State to allow the sending of two assistants on the Melbourne Exposition Commission, and through their labors the desired result was reached. Hundreds of specimens of an Australian lay-bird (*Vedalia cardinalis*) were introduced into California, and the dreaded pest is now being speedily reduced to absolute harmlessness. Professor W. A. Henry, of Wisconsin, in a recently-published article, says of this matter, in speaking of the enthusiasm of the people of California over the results of this importation: 'Without doubt it is the best stroke ever made by the Agricultural Department at Washington.'"

It might be thought that all this administrative work of the office and in the field would have left little time for pure science or for much general reading or deep thinking. Let us see what he actually did accomplish in pure science. Riley's scientific writings will always stand, and show as honest work, thorough-going methods, care and accuracy as his office work, and they alone, aside from his practical work, were enough to give him an international reputation. In some of his studies he was probably essentially indebted to his assistants for specimens and aid in rearing them; in others he evidently depended on his own unaided observations and his skill in drawing. He was not "a species man" or systematist as such; on the contrary his most important work was on the transformations and habits of insects, such as those of the lepidoptera, locusts and their parasites, his Missouri reports being packed with facts new to science. His studies on the chronology of all the broods known of the seventeen-year cicada, and its *tredecim* or thirteen-year race, carried on through a long succession of years, will prove of lasting value, having intimate bearings on evolution problems.

His work on the larval characters and hypermetamorphoses of the blister beetles, Epicauta, Macrobasis and Hornia, besides Henous, was thoroughly good and beautifully illustrated by his own pencil. He brings forward in this paper a mass of new facts regarding the triungulin, or first larval stage of these beetles, and those succeeding, which he designates as the Carabidoid, the Scarabæidoid stage, the Coarctate or quiescent larva, these stages preceding the pupa stage. The value of these facts as set forth by so trustworthy and keen an observer, and corroborating and greatly extending those worked out by European observers, is apparent when we consider that the triungulin larva is perhaps the nearest approach to the Campodea-like ancestor of the winged insects, that the Meloidæ are consequently among the most primitive and generalized of Coleoptera, and that from work based on such studies as these of the life-history of this and allied groups there has already resulted the germs of a truer phylogeny or classification of the entire order of Coleoptera. Of similar import are Riley's papers on the larval habits of bee-flies, on the luminous larviform females of the Phengodini and on the first larval stage of the pea-weevil (Bruchus). His studies on the systematic relations of Platypsyllus as determined by the larva evince his patience, accuracy and keenness in observation and his philosophic breadth.

For over twenty years he made observations on the fertilization of Yucca by those remarkable tineoid moths, Pronuba and Prodoxus, and from time to time published papers and notices of progress in his work which culminated in his paper entitled, "The Yucca Moth and Yucca Pollination" (1891-'92), a memoir remarkable for the patient, unremitting work carried on during his spare hours, its thoroughness in dealing with structural details, its critical accuracy, and for its faithful and artistic drawings. It is a paper of interest to botanists as well as zoologists, and of value to the student of evolution. One of his last papers was a continuation and résumé of this subject, entitled "Some Interrelations of Plants and Insects" (1892).

Riley's contributions to the history and structure of the Phylloxera, of the scale insects, of the hop-plant louse, the Pemphiginæ, Psyllidæ, etc., are of permanent interest and value. His best anatomical and morphological work is displayed in his study on the mode of pupation of butterflies, the research being a difficult one, and especially related to the origin of the cremaster, and of the vestigial structures, sexual and others, of the end of the pupa. Whatever he did in entomology was original. He may occasionally have received and adopted hints and suggestions from his assistants, but he laid out the plan of work, supervised every detail, followed up the subject from one year to another, and made the whole his own. His originality in a quite different direction from biology is seen in his paper entitled "Perfectionnement du Graphophone," read before the French Academy of Sciences at Paris, in 1889. He was also much interested in Aëronautics, and took much delight in attending séances of spiritualists and exposing their frauds, in one case, at least, where another biologist of world-wide fame, then visiting in Washington, was completely deluded.

Riley was from the first a pronounced evolutionist. His philosophic breadth and his thoughtful nature and grasp of the higher truths of biology is well brought out in his address on "The Causes of Variation in Organic Forms," as Vice-President, before the biological section of the American Association for the Advancement of Science in 1888. He was a moderate Darwinian, and leaned, like other American naturalists, rather to Neo-Lamarckism. He says: "I have always had a feeling, and it grows on me with increasing experience, that the weak features of Darwinism and, hence, of natural selection, are his insistence (1) on the necessity of slight modification; (2) on the length of time required for the accumulation of modifications, and (3) on the absolute utility of the modified structure." Riley, from his extended experience as a biologist, was led to ascribe much influence to the agency of external conditions, remarking, in his address: "Indeed, no one can well study organic life, especially in its lower manifestations, without being impressed with the great power of the environment." He thus contrasts Darwinism and Lamarckism: "Darwinism assumes essential ignorance of the causes of variation and is based on the inherent tendency thereto in the offspring. Lamarckism, on the contrary, recognizes in use and disuse, desire and the physical environment, immediate causes of variation affecting the individual and transmitted to the offspring, in which it may be intensified again both by inheritance and further individual modification."

The following extracts will illustrate his clear and vigorous style of thought and expression and his attitude on the relations between science and religious philosophy. Regarding the question of design, he says: "Both Lyell and Gray believe in the form of variation having been planned or designed. It seems to me that the evidences of design in nature are so overwhelming that its advocates have an immense advantage over those who would discard it. A fortuitous cosmos is, to most persons, utterly inconceivable, yet there is no other alternative than a designed cosmos. To accomplish anything by a process, or by an instrument, argues greater, not less power, than to do it directly, and even if we knew to-day all the causes of variation, and understood more thoroughly than we do the method of evolution, we should only carry the sequence of causes a step further back and get no nearer to the Infinite or Original Cause."

"Evolution teaches that nothing is yet so perfect but it may be improved; that good comes of the struggle with evil and the one can never be dissociated from the other. The erect position which has given man his pre eminence has brought him manifold bodily ills. No evolutional sibyl looks to a millennium. Higher development must ever mean struggle. Evolution shows that man is governed by the same laws as other animals." "Evolution reveals a past which disarms doubt and leaves the future open with promise—unceasing purpose—progress from lower to higher. It promises higher and higher intellectual and ethical attainment, both for the individual and the race. It shows the power of God in what is universal, not in the specific, in the laws of nature, not in departure from them."

"The experience gained by those who have reached the highest ethical and intellectual growth must be formulated in precept and principle to be of any benefit to society at large, and the higher ethical sentiment and religious belief—faith, love, hope, charity—are priceless beyond all that exact science can give it."

Riley, an excellent head of a bureau, but sometimes uncomfortable and too independent as a subordinate, at times got into hot water with his superiors in the Department. He was sensitive to criticism, and was somewhat prone to controversy, usually, however, winning in such encounters. Until one came to know him more intimately he was liable to be misunderstood, and by his occasional bluntness made some enemies, but as years rolled on these passing antagonisms melted away.

Vigorous in mind and body, though of late years suffering from overwork, fond of out-door sports, he was a fearless rider on horseback, and an adept with the bicycle, on which, alas, he rode to his death.

His hospitable house at Sunbury was beautified by rare flowers, shrubs and trees, of which he was passionately fond. He was domestic in his tastes, and left a wife and five children to mourn his loss.

Riley left an indelible mark on his time, and the historians of natural science and of agriculture in America will scarcely ignore the results of thirty years of earnest work in pure and applied entomological science.

His scientific honors were well deserved. He was a member of many societies at home and of the entomological societies of France, Berlin, Switzerland and Belgium. He was elected in 1889 an Honorary Fellow of the Entomological Society of London, and was also Honorary Fellow of the Royal Agricultural Society of Great Britain. He was for two years President of the Academy of Science of St. Louis, being the youngest member so honored. He was founder, and for two terms President, of the Entomological Society of Washington, one of the founders of the Biological Society of that city, and an honorary member of the horticultural societies of Illinois, Iowa, Kansas and Missouri. The Kansas State Agricultural College gave him the degree of A.M., and the Missouri State University, in 1873, conferred upon him the degree of Ph. D. He was lecturer on entomology at Cornell University and at other institutions.

A. S. Packard.

Brown University.

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TWENTY-SEVENTH ANNUAL REPORT

OF THE

FRUIT GROWERS' ASSOCIATION

OF ONTARIO

1895.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.

TORONTO:
WARWICK BROS. & RUTTER, PRINTERS, ETC., 68 AND 70 FRONT ST. WEST.
1896.

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TWENTY-SEVENTH ANNUAL REPORT

OF THE

FRUIT GROWERS' ASSOCIATION OF ONTARIO,

1895.

To the Honorable John Dryden, Minister of Agriculture:

SIR,—I have the honor to transmit to you the Twenty-seventh Annual Report of the Fruit Growers' Association of Ontario. The meeting at Woodstock was well attended by interested fruit growers, and the subjects brought forward by the fruit experts from various parts of our province were of public concern, as, for instance, Spraying of Apple Orchards, Packing and Grading Fruit for Export, Causes of Barren Fruit Trees, etc. It is believed that the remedies under consideration will be the means of bringing to our fruit growers an era of more fruitful and consequently more profitable orcharding.

I have the honor to be, Sir,

Your obedient servant,

L. WOOLVERTON,

Secretary.

GRIMSBY, January 8th, 1896.

OFFICERS FOR 1896.

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Division No. 12 ..... G. C. Caston, Craighurst.

AUDITORS.

A. H. Pettit ..... Grimsby.
George E. Fisher ..... Freeman.

THE ANNUAL MEETING, 1895.

The annual meeting of the Fruit Growers' Association of Ontario was opened on Wednesday, December 11th, 1895, in the town of Woodstock.

THE PRESIDENT'S ADDRESS.

Mr. Murray Pettit, of Winona, President of the Association, occupied the chair, and delivered the following address:

The season through which we have just passed will long be remembered by horticulturists as one of unprecedented frosts and drouths in almost all portions of the province. As a result the fruit crop has been more or less damaged, and in many cases ruined. The almost entire absence of fungus diseases have in a measure compensated the loss, and our markets have been fairly well supplied with a much better quality of fruits than in former years. The result of the drouth has been like a mathematical demonstration of the saying, "Good drainage, good cultivation, and plenty of manure, will enable land to stand almost any amount of drouth and still produce crops." I regret that I am unable to give any statistics in regard to the past season's crop, as it is impossible to gather anything reliable, even from local sections of the province. It is unfortunate that in this age, when every line of business is more or less dependent for success upon statistical data, that we have no better means of acquiring this information. During the past year many new horticultural societies have been formed, through the enthusiastic work of our old director and co-worker, Mr. Beall. These societies bring people together for the comparison and the enlargement of views. The local societies gather and formulate the experience and wisdom of the community. It is then brought to this Society to carry on and complete, and from one end of this province to the other to-day can be seen the deep imprint of organized horticultural activity. It is seen in the bending orchard, the burdened vineyard and fruitful garden. Fruit growing is becoming one of our great industries, whole farms are being planted and given the most scientific care and cultivation. Thousands of homes are fully supplied with fruits and flowers from their own gardens, and there is yet grand work to be done through organization. Should we allow the far-off valleys of California to supply the demand at our very doors that our own fruit should supply, annually taking thousands of dollars from this Dominion to support the fruit growing industries of another country while we are looking anxiously for markets? Does it not teach us that we must produce more good fruit, and less of an inferior quality; that we must cultivate, spray, fertilize and thin, pick, grade and pack better? When we notice the yearly growth of competition in the fruit markets, it becomes clear to us that the time has come when we must grow such varieties of the various fruits as we find succeed best in the various sections; in other words, we must make specialties of growing only such kinds as we can bring to the highest state

of perfection. A portion of our fine large apples and other fruits should be wrapped in paper to meet the demand of the better class of trade. The growth of the fruit-growing industry, and the rapidly increasing demand in the markets of the world for the very best, will compel us to take these advanced steps in our profession or be left in the rear to meditate over lost opportunities. The ratification of the French treaty will be a severe check on the rapid growth of the grape-growing industry of this province, and will increase the importation of foreign wines, as the conditions of this treaty will allow all countries the same privileges. The concessions made will involve a loss of revenue amounting to $60,000 annually on the basis of importation from France in 1892. We fail to see why our wine-producing industry should be exempted from the full advantages conferred by the National Policy, and sacrificed to the interests of a foreign country. The developing of markets is one of the most important questions in connection with the fruit growing industry of this province. It is much to be regretted that the trial shipment of over ten tons of our choicest fruit to Great Britain was a failure; it is also a matter of congratulation that the Dominion Government has promised to make several trial shipments next season. At the last session of the Provincial Parliament the Hon. Minister of Agriculture introduced and carried a bill to suppress frauds in the sale of fruit. This is in the direction that this Association has always advocated, viz.: a better system of picking, grading and packing fruit, which means a greater consumption and more extended markets, While we are grateful for this, does it reach far enough? Should not the grower be protected? How much greater is his loss, when after purchasing, planting and cultivating an orchard for years, he finds it not true to name and of worthless varieties? Should we not ask for still more? New insects are continually appearing, also fungi not before observed, in different countries; trees from these countries are being imported every year into this province, and as the inroads already made by these enemies to fruit culture are a serious loss to the grower, should we not ask to be protected from such formidable enemies as the San Jose Scale and others, by the enactment of such quarantine regulations as now exist in California, which makes provision for all plants, trees, cuttings, grafts, buds, scions, seeds or pits brought into the state, to be disinfected on arrival at any point where they are to be unloaded; and for all peach, nectarine, apricot, plum or other trees, budded upon peach stocks or roots, and all pits raised or grown in a district where the peach yellows or peach rosette is known to exist, to be prohibited from being planted or offered for sale? Good results are already being seen from the amendments made to the Black Knot and Yellows Act. In my own township, where the diseases were spreading to an alarming extent, after vigorously enforcing the act for two years scarcely a vestige of the diseases remains; and it can, I believe, be entirely stamped out. The very thorough and complete system of spraying experiments conducted under the Provincial Government during the past season will, I trust, give us valuable results, and no doubt will be one of the most interesting subjects on our programme. It is such an important matter in our work and one in which there is yet so much to be learned that I trust we will be able to give it a good share of our time for discussion. Many improvements will yet have to be made before our spraying apparatus will reach the desired end

for which it is intended, without the loss of a great deal of time and patience. Any of them while new will spray pure water to perfection, but after one or two seasons' use with Bordeaux mixture they are failures. The question of forestry is of too great importance to be overlooked, in my estimation it overshadows all other questions of public economy to-day. The destruction of the forest areas has unbalanced the forces of nature, our climate is becoming full of extremes. The situation is one that challenges the attention of every thoughtful man. Wood lands should be preserved by absolute force where the Government has the right, and by all encouraging legislature where it has no control. To demonstrate the financial injury that is being inflicted on the present generation by the waste of material and the wrong that is being done to posterity by the destruction of young growths and germs of future forests by domestic animals should be one of the first duties of every society or association connected with agriculture, and this Association above all others should take the lead. The planting and beautifying of our school grounds, parks, cemeteries, homes and highways has received considerable attention from this Association, and will, I trust, receive still more.

COMMITTEES.

The following committees were appointed:

Fruit—Prof. Hutt, Mr. Race and Mr. Nicol.

Committee on Resolutions—G. R. Pattullo, W. M. Orr and A. M. Smith.

Committee on Nominations—The President nominated A. M. Smith and Mr. McNeill; the meeting nominated D. W. Karn, T. H. Race and G. C. Caston,

The Secretary read letters of regret from J. A. Morton, Wingham; R. B. Whyte, Ottawa; Sir Oliver Mowat, Prof. Panton and Sir Richard Cartwright.

GREEN FRUIT: HOW CAN WE PREVENT ITS FLOODING OUR MARKETS?

Mr. A. M. Smith, of St. Catharines, read the following paper:

I believe it will readily be conceded that anything that brings discredit upon the fruit business or creates distrust between the producers and consumers of fruit is a proper subject to bring before this meeting for discussion. In the past we have had the subject of dishonest packing—putting all the best samples on top of the packages and the culls in the bottom—discussed with good results, and there has been a remedy provided. Now there is another grievance among consumers, and though not of such a glaring character, yet it is one which if let alone may assume proportions that will seriously injure the trade. I refer to shipping green or immature fruits to our markets. Of course in shipping to distant markets some kinds of fruits require to be picked before fully ripe and will mature during and after transportation. Take pears, for instance; while grapes if picked before they are ripe, though they may be partially colored, will never ripen or be fit to eat. Pears even and peaches if picked too green will not ripen, but will shrivel up and decay. But it is grapes more particularly, and fruit picked at this stage of immaturity that is the subject of complaint. There are a great many men, and I think they are closely related to the dishonest packers, who as soon as their fruit begins to color, hurry it off to market in order to get ahead of their neighbors and secure

a big price, thinking the scarcity and looks will sell it, not stopping to think or seeming to care about its effects upon the stomachs of the consumers or upon their own reputation as fruit growers. They remind me of a story I heard at a fruit growers' meeting in Rochester about a down east Yankee who was pretty sharp and had taken advantage of some of his neighbors in sundry horse trades and other deals, and among others had cheated a fel'ow by the name of Jones. It happened there was a protracted meeting in the place and a good many were converted, and among the rest this sharp Yankee saw the error of his ways and professed conversion. One night he got up in the meeting and told the brethren that he knew he had been a great sinner, but he was going to do better and if he had wronged any of them he asked their forgiveness, and if they would come to him he would make restitution. Next morning Jones was at his house long before daylight and rapped at the door. The man wanted to know what was up and what he wanted so early. "Wal," says Jones, "you know what you promised last night in the meetin', you said as how you was goin' to pay all of us fellows back you had cheated and I thought I'd get here 'arly, for I knowed there would be a terrible rush." These fruit growers think there is going to be a terrible rush and the market will be glutted and they want to get there first. The consumer buys it because it is the first in the market, takes it home before he has a chance to test it, and is disgusted with it. The children, who are willing to eat anything that is fruit, devour it, and there is a sleepless night and perhaps a doctor's bill to pay. In consequence that man does not bring home any more fruit for a month. This class of fruit is not ordered from the grower by dealers who have any regard for their reputation, but is consigned by him to commission men who generally sell it to retailers, who dispose of it to consumers. I have corresponded with some of the leading commission men in London, Toronto, Ottawa and Montreal, and they all admit that it is an evil and hurts the market for better fruit; but they say it is a difficult question to deal with. They admit there are tons of grapes sold every year at high prices that are not fit to eat. People buy them because they are first in the market, but the retailers say they seldom come back for the second lot. The commission men of course do not like to refuse to handle this early fruit, for if they did they would lose the handling of the remainder of the crops, and it often sells at high prices and they make a corresponding profit. Nevertheless one of them told me he frequently had losses in handling it. His customers would come back after he had made returns to the grower complaining of its rotting on their hands and he had to help make good their loss. The only remedy suggested by them is from one who thinks the commission men should combine and refuse to handle it and thus drive it from the market. I leave the question with you, trusting some way may be devised to remedy the evil.

The SECRETARY: I think the evil of selling frozen grapes should be included with that of selling immature fruit. They were hurried into the markets, and people who tasted them did not want any more, and people who had stored good grapes in their cellars found no sale for them.

Mr. MCNEILL: This matter of selling green and frozen and immature fruit is doing a great deal of damage to the fruit grower, but the remedy suggested is only a partial one, though not altogether ineffective. Another partial remedy may be had in the matter of co-operative selling. It appears to me that in Ontario we are a little behind the times in selling our fruits; and many of these evils might be remedied if we could go in for some system such as is working on the other side of the line. Instead of shipping individually, if it were possible to ship co-operatively, and thus secure some union, the temptation to ship green fruit would be removed. Just so long as there is competition, immature fruit will be put on the market, because the man who ships the first fruit gets the highest price, and therefore he considers it essential that he should have fruit from his own orchard. I have orders for grapes every year if I can put them in at a certain date, and with the invoices of my first shipments I always say: "This fruit is not matured, and does not represent the quality of our grapes;" but I cannot afford to refuse to sell green fruit. We all do it; everybody does it. If people can get a colored fruit that looks all right they want it, and there is not a shipper among us that does not do it. The best price I get is from this immature fruit. We pick just as soon as it gets black, and

we have a greater profit from those vines than we have from any grapes on the farm. I am satisfied it is a loss to the fruit growers as a whole; but it is a gain to me individually if I can put fruit on market a day or two ahead of my competitors. In our section, where the sale of grapes is in the hands of comparatively few growers, I do not see why we could not form a selling corporation among ourselves and have the results pooled, so as to remove entirely the temptation to ship immature fruit, and also ensure greater economy in the shipping. The same correspondent who now sells our crop will sell our neighbor's crop as well. The mere amount spent in securing market reports and in many other ways for my own would sell my neighbor's fruit as well, and I would be none the worse off, because we could sell for better prices, and the consumption, instead of being lessened would be increased, because we could open up markets for the whole of us that would not pay any individual to open up. If we had some such organizations as the Niagara Stock Fruit Company, and had them change their methods, so that instead of appointing agents in different cities and resting with that, they should secure contracts from growers, insuring that these agents had a supply of fruit that they could handle as best suited the needs of the market, it would not be very difficult to start with grapes and extend the plan to other fruits if it were found to work well there. Therefore I would commend to the fruit growers here this idea, and to urge upon this company, as it is already established and composed of reputable gentlemen whom we all trust, and endeavor to bring such pressure to bear upon them as would induce them to take up this plan and devise some scheme by which they can secure from growers their crops for sale, and handle it in that way without appointing agents. Not that they would abandon appointing agents entirely, but they should not rest on that system alone. I think the appointing of agents in some cases is not advantageous; it is putting another middleman where there are too many already, but in some cases it would be necessary. The fruit exchanges in New York State and the grape districts on the other side and in the peach districts of Delaware State, work very satisfactorily. I believe it did not work satisfactorily in Michigan, but we have some representatives of that state here who might enlighten us.

Mr. Watkins, of Michigan, said: We came over here not to give you any instruction in fruit growing or horticulture, but rather in order to learn something ourselves; but if we can say anything that will help you we shall be only too happy to do so. (Applause.)

Mr. L. B. Rice, of Port Huron, Michigan: The question was asked by the President of our Society last week in reference to the matter Mr. McNeill refers to—why farmers and fruit growers cannot organize themselves into co-operative companies to build cold storage houses at the centres of shipment, and in that way have their fruit assorted and sent out under commission as he suggests—why it is that dealers so soon creep in and those things go to the wall? Professor Bailey, of Cornell University, and others answered that we must first broaden the foundation of the business education of the farmer so that he will rise above these petty jealousies, and then we can combine; so that your work has to go deep and thorough to ever succeed with these combinations. (Hear, hear.)

Mr. Caston (Craighurst): In the case of grapes, plums and peaches I think that growers find it necessary to pick them a little on the green side in order to have them stand for a few days in the basket, and the transportation companies and some expressmen do not give them very gentle handling, and fruit, with the exception of the pear, if picked before it is ripe, is to a certain extent insipid. Some varieties of the Roger's grape if picked before ripe are fit to eat, but other varieties are not; and it is so with some fruit for canning purposes, which, as a rule, are picked a little too much on the green side. They come in contact in the grocery and fruit stores with California fruit, and the amount of the latter that is sold in this country is surprising. People will pay a little more for it. Mr. Orr suggests that it is on account of their dry climate that their fruit will keep much better. Theirs is grown in a perfectly dry atmosphere, while ours is grown in a moist atmosphere and cannot keep so long. This is a very difficult problem to solve. It is a question of quick transportation and sale more than anything else. Growers are afraid to leave their peaches and plums and other perishable fruit on the tree till they are ripe, because they know they will be in a bad condition when they are sold. You cannot ship apples to the North-west unless you pick them in a condition when they are

absolutely insipid. One of our dealers tried this plan last summer, but only the Duchess got there all right; the Astrachans he had a serious loss on. The Duchess is a splendid apple, and in high favor if you get it at its right stage; but you cannot get it at its right stage and send it any distance. I cannot offer any solution of the problem except quick transportation and quick sale.

Mr. MORDEN (Niagara Falls South): There is another question, of careful handling. The great difficulty we have to contend with in fruit transportation to-day is that it is bruised all to pieces. Last summer I sent a picking of berries to Buffalo, twenty miles away, and they were handled all right on the train, but when they got two or three streets away, by some race-horse methods that they adopted, they had those berries mashed, and almost destroyed the price of them. Now, if we could get a quick and careful transport a good deal of this difficulty would be avoided.

Mr. CASTON: Another question in regard to transportation might be mentioned. I never received a consignment of grapes that had not been broken open and quantities of them stolen. (Hear, hear.) A friend of mine had some peaches shipped to him and he would only accept them for what was in the basket. The express company tried to make him pay for the full amount, but he refused to do it, and finally they accepted pay for what was there. In some of the packages half of them were gone. It is simply disgraceful.

Mr. MCNEILL: That is the fault of the shipper himself. We have frequently had baskets opened, but make it a matter of principle to follow every such case to the bitter end, and sometimes I follow a case for six months till I get a rebate of perhaps a dollar on the shipment. In the winter months I take all these complaints and follow them up, and I have never failed to have the freight and expressmen make the loss good. I can say to their credit they have never failed, when I have brought home to them the undoubted proof of loss while in their hands, to have the loss made good. I have correspondence two inches thick over some trifling shipment where the basket was broken into. When carriers know they are being watched by the shipper they will not break them open. Shippers are to blame in not following up these losses by a persistent system of inspection.

APPLE CULTURE.

Mr. E. HERSEE, of Woodstock, read the following paper:

We learn that the apple formerly originated from the wild crab of northern Europe, and now it is cultivated throughout the whole world, and the fruit we now enjoy is so entirely unlike the original species that we hardly recognize it as belonging to the same. Yet if we plant the seed of our most improved varieties it reverts to its original type, so by the good cultivation and the improved condition of the soil, with the workings of our experimental stations and of our fruit growers' associations, we have been enabled to bring to the front many new and improved varieties.

My idea in apple culture is to strive and improve on previous years' methods.

There are now in existence many notions in regard to cultivating the orchard, and these suggestions have led inexperienced people to suppose that no one but an experienced person could do the work. *This is a mistake.* I would say let us get acquainted with our trees, look at them, visit them daily; they need it. For example: Put a horse in a field and let it care for itself; will it do well? I think not. So trees need our attention and our daily visits.

My experience gained in planting a young orchard is that the growth must not be checked. We must not expect that a tree planted in the grass with simply a small portion of the sod worked around it will make the same growth that the same tree would if planted in cultivated soil. I would say a tree planted in cultivated ground will make three times more growth than one planted in the sod; the grass will exhaust the soil of its moisture and fertility, and the consequence is the tree will only exist.

The question is often asked, can I crop my orchard? This is an important question, but I would say, yes; such crops as the following have been found desirable for a young orchard, and then not too close to the trees. Corn is a good crop, as it does not attain much growth until most of the tree-growth is made. Potatoes are not so good, as the growth is at the same time as that of the trees Also good crops of carrots can be raised, short-rooted sorts being preferred. A fall crop of flat turnips can be grown without harm. Strawberries, currants, gooseberries, rhubarb, can be grown without injury to the orchard. All this must be understood to be done under good cultivation and the free use of manures, stable manure being preferred, with an annual application of potash or wood ashes. My reason for suggesting the cropping of the young orchard with crops mentioned is this, that we are more liable to make free use of the cultivator than we would otherwise do if we had put it into grass or grain. But, as a rule, such crops will hardly pay after the trees are three years planted The owner must then take his profit out in the increased value of his orchard, as I do not think it is wise to crop after that time. The cultivation of young orchards should cease each season about August 1st, as it is almost certain to prolong the growth, and the trees will be injured through the winter.

A few words about manuring. For young trees stable manure will always be found good, and the best time to apply it is in the fall, or very early in the spring. If put on through the summer it produces late growth, which is injurious to the trees. For orchards that have reached maturity, and are bearing heavily, manure can be used more freely, especially in the spring of the fruiting year, for a good many trees are weakened by their effort to produce a large crop of fruit, and especially if it be a dry season. Trees that are weak from fruiting or poverty of the soil are more subject and liable to disease. A good many fertilizers are now being manufactured which are profitable to use on the orchard, but I think bone and potash the best suited for producing fruit.

In conclusion, I would say the pruning must not be forgotten from the first year the trees are planted. They should have constant attention. Go and visit them every day if possible and see how they are doing. You will get to like them. What looks better on the farm than a well-pruned and well-kept orchard? Yes, and what pays better? Young trees should be allowed to grow with a close head. After forming the head, little is needed each year but to keep it balanced and regular in shape, pinching out the buds of those branches that are outgrowing the others. If it is found branches are crossing each other and are liable to come together, cut them out at once. Do not wait till they get large and then do it. This will injure the tree, weaken and shorten the life of it. And do not forget to let the sunshine and air into your trees.

I would say, lastly, to farmers and others, give your boys a start in growing fruits. They will learn early how to manage and care for them, and it will thus be a means of profit to both parties. Fruit appreciates good care and attention, therefore do not become disheartened. Become a member of the Fruit Growers' Association, read the *Horticulturist* and learn what it is and you will get your reward.

Mr. MORDEN: I do not know upon what grounds potatoes in orchards are objected to. I understand potatoes use a good deal of potash, and in a soil deficient in potash if we were to plant potatoes it might be necessary to restore the potash. If so, that would get over the difficulty. I have seen the practice of planting potatoes a year previous to the strawberry condemned because the potatoes are a potash crop. I would like to hear from gentlemen with more chemical knowledge than I have on this matter. Potatoes in many ways are very suitable. They are often dug quite early, you cultivate the ground quite frequently during the season, and also in digging the potatoes out.

Mr. HERSEE: The growth of potatoes is the same with that of the trees—that is, at the same time—and hence they are objectionable.

Mr. RACE: I made a point of planting strawberries in the fall after taking out a crop of early potatoes, and I have recommended that to the farmers.

Mr. GREINER (Niagara Falls, N. Y.): We have at various times planted potatoes amongst young trees in the orchards, and I do not think that the practice should be in any way objected to if the potatoes have the proper food and the trees have the proper

food. As long as you grow double crops you will use double manure. In regard to strawberries following after potatoes, it is exactly the same principle. With good culture, with the manure that the early potatoes usually receive—and we always manure early potatoes very heavy, more so than late potatoes—we think that the land is brought in the very best state for the succeeding crop. I do not see a single reason why we should not plant strawberries after potatoes. Of course the potato requires potash; therefore we usually feed potash manures a little heavier. If we use the concentrated fertilizers we take the special potato manures which contain a very high percentage of potash—sometimes as high as ten per cent.—or, as I usually prefer, we use the potash salts directly, unmixed, by sowing the same way as we sow grain over the land broadcast, and I have seen good results from that. On the whole it is a question simply of cultivation and manuring.

Mr. Rice: One of the points in the paper should not be overlooked—the one in regard to using suitable manures. We are troubled a good deal with dry seasons, and if manure is put on in the spring it is very apt not to assimilate itself to the soil, so we have to be very careful in applying suitable manures to the soil in the spring of the year.

Mr. Morden: When do you apply manures, then, to an orchard?

Mr. Rice: I should apply it late in the fall without cultivating it into the ground.

Mr. McNeill: You may plant an apple orchard and grow fruit well and do this as often as you please, but if you fail to get the right varieties there is no profit in it. The whole question turns on a matter of varieties. Thousands of trees in this province to-day are worthless because of not being the right varieties, and there are hundreds of farmers discouraged because they have no information on the proper varieties. As in grape culture, the money is made on two or three varieties.

The President: That was the case when these orchards were being planted; but now this Association has a carefully prepared list suitable to the different sections of this province and recommended for planting by this Association.

Mr. Caston: The question of varieties is a question of locality to a very great extent. As to manuring, my observation leads me to the conclusion that the best way to supply nitrogen to the soil is to plow in clover. The mechanical condition of the soil furnished by a great amount of humus is a great advantage. Where we have a bare soil without sufficient humus the tree does not do so well apart from the fertilizing. We can supply a concentrated fertilizer having a large percentage of potash and a sufficient quantity of phosphoric acid and supply the nitrogen by plowing in clover. I never advise the seeding down of an orchard except with red clover that should be plowed under when it gets to its very best. Do not apply any stable or barn-yard manure at all to the orchard. It can be better furnished by plowing in a heavy crop of clover, and the other ingredients supplied by ashes.

Mr. Turner (Cornwall): Mr. Caston has struck an important point in reference to humus. There is too much humus taken out of the soil and too little put back. I have grown a patch of strawberries for two years, and since the crop was taken off I cleaned out the patch and sowed red clover, and as soon as that was in blossom I turned it in. I expect to have some splendid soil for strawberries next year.

The Secretary: I do not think it should go out from our meeting that we do not recommend barn-yard manure for our apple orchards or for any of our garden plantations. I have always been under the impression that barn-yard manure was the best fertilizer that could possibly be applied, because it contains the various ingredients that we want to get in our orchards. It is the most complete fertilizer perhaps that we can apply; but because of the lack of barn-yard manure and the impossibility of furnishing enough of it for our orchards, it is necessary to use commercial fertilizers. In a barn-yard manure we furnish a certain amount of humus also. In regard to orchard crops, I think buckwheat is one that is easily grown and easily sown after we are through with our other farm work, and which cleans the orchard of weeds, and is in my opinion a very desirable crop—not quite so desirable as hoed crops, which mean a lot of cultivation through the summer; but buck-

wheat answers a good purpose and also saves us a large amount of work which we perhaps would not have time to do. Speaking of varieties, I think a good deal of the Cranberry Pippin. I do not know that it is widely known. I have a clipping from the *Produce World*, of London, England, which draws special attention to the Cranberry Pippin as being a desirable apple in the London market. A correspondent in Scotland to whom I sent a hundred cases of this apple this season wrote me a letter recently in which he said that it sells well just now, bringing a high price, but still he does not know about recommending it for a standard fancy apple for their market, which I had proposed it for. From Glasgow I hear very favorably concerning the apple. I packed 500 boxes and scattered them over Glasgow, Edinburgh and Sydney, N.S.W. When the reports come in I can tell whether this apple is going to succeed.

Mr. McNeill: What are the defects of the apple?

The Secretary: In some soils it is inclined to have little warts on it. It does not spot. For two years I have had the finest of samples. Its chief defect is in its quality, which is only ordinary like the Ben Davis.

Mr. Caston: I believe they are growing that apple in some localities under the impression that it is the Gravenstein.

Mr. Boulter (Picton): I see by the heading of Mr. Hersee's paper that he is the proprietor of nurseries. I read his paper over carefully, and I must say there are a great many good points in it. However, we have learned a good deal by experience—a pretty good school, but the tuition is very, very high. I think one of the most important things to tell a man who is starting out, or an old man who is willing to learn, is how far apart to put his apple trees. In 1878 I put out 1,000 trees, 24x36. I was persuaded that I could grow as much again of fruit if I would stick another row in; consequently I inter-rowed them. In the spring of 1879 I bought another thousand and put them out, 24x36, and I let them remain and did not inter-row. I have carefully kept those apple trees pruned very close, because I claim that every tree requires a peculiar manner of trimming. You would not trim a Spy like a Talman Sweet or a Greening like a Ben Davis. I made the serious mistake of my life in that orchard. I have carried out a good many experiments, particularly the washing of those trees every year with good strong lye made from good wood ashes. I burn up some six or seven acres of wood every year, and every pound of the ashes has gone on that orchard for the last twelve or fourteen years. After the trees are out seventeen years I have got to go to work and cut out that alternate tree or else not raise a crop of Northern Spys that will compare favorably with any others that are on the market, although the trees are all right and growing beautifully. You must let the sun and air into your trees to get the colored apples. Last spring I put all my manure on the orchard and plowed it in with a gang-plow. It was too dry; I got no benefit from it this year. The frosts of last spring hurt my orchards fearfully. You can't grow a good Spy where the sun cannot strike it. You do not want your trees nearer than thirty feet.

Mr. Beadle: Say forty.

Mr. Boulter: It depends on how much land you have. If you have two hundred acres of land I would say spread them out.

Mr. Race: You would not recommend these people to wash a very young tree with very strong lye?

Mr. Boulter: I would recommend as soon as the tree was out two years to wash it with very weak lye. Take one-third an ordinary run of ashes and two-thirds water; and as the tree grows increase the strength of the lye. Do not be afraid to put it on strong as the tree is four or five years old, and you will have no lice, no moss growing on it and no rough bark. The bark on my trees is apparently just as smooth as the day they were put out. The tree should be looked after just as well as the ground upon which it is grown. A poor fellow down at South Bay told an agent, who had offered to put in his trees—that he wanted them put in "top down." The agent asked what for, and the man replied, "because for fifteen years I have been putting them out roots down

and I can't make them grow." (Laughter). Every one of my two thousand trees I trimmed with a jackknife myself, and I did not leave a sprout over eight inches long on any one of them. You can grow a top any time you like. Get a good trunk and the top will come out all right. Too many put out trees and never trim and cut back. It is of the utmost necessity to cut the top well back the first year. I do not put anything in my orchard. I calculate that the trees will need all that the ground will produce. We go through it with a gang-plow when necessary, and we keep it worked up with a large spring-tooth harrow—just keep the weeds worked down and keep all the manure in it I possibly can. I believe nothing can be put on an orchard that is better than good wood ashes.

Mr. Rice: I find that when I put buckwheat on my land we have no cutworms the following season.

I sow the buckwheat about the first of August, because I do not want to take it off my ground nor to ripen too much while my trees are young so as to harbor mice. Another thing we have to look at is, that if your ground is bare during winter, the rain that falls on it packs it harder and harder and does not sink into the ground, but runs off and is not there to be raised by capillary attraction the next year to furnish the moisture needed in your orchard. To prevent the rains from washing off the ground I mix a liberal amount of rye with the buckwheat so when the frosts come the buckwheat is killed down and forms a little protection with the straw, and then the rye comes on. In the spring plow your rye right under and go on with the cultivation of your soil. Thus you give the moisture to the soil, you protect your soil from the hard freezings, and all that sort of thing, and you furnish humus.

Mr. Caston: I believe it possible from my own experiments to furnish the necessary manure to an orchard without the use of barn-yard manure at all. One of the most successful farmers in west Ontario considers clover the sheet anchor of farming In regard to the time of plowing under, we find that clover is in that state early in June. We have sufficient moisture in the soil. If we plow it under, then we find in August when the drouth is at its greatest, that we have the ground in the very best mechanical condition; and I will guarantee that you can find the moisture within an inch or two of the top where that clover is plowed under.

APPLE GROWING IN THE VALLEY OF THE UPPER ST. LAWRENCE.

Mr. Harold Jones, of Maitland, read the following paper:

Before entering on the subject of this paper I will endeavor to give you an idea of how favorably we are situated for the growing of most of the hardier fruits.

The land draining into the river from Kingston to Cornwall, a distance of about 120 miles, is more or less adapted to fruit raising, but I will speak more particularly of that section lying in the vicinity of Brockville, where I can speak from personal knowledge and experience.

The general character of the soil is from clay loam to gravel and sand, and for a distance varying from one to three miles from the river is exceptionally free from late spring or early fall frosts; only once in my memory have we had a spring frost that would injure the grape blossoms, and we have never to my knowledge lost an apple crop through the same cause.

Among the summer and early fall varieties of apples that have proved hardy and prolific with us, I might mention the Yellow Transparent, Red Astrachan, Brockville Beauty, Duchess of Oldenburg, and St. Lawrence.

Of these the Duchess is without doubt the best paying of its season, well maintaining its character for hardiness and freedom from fungous diseases. The St. Lawrence, when kept free from spot, comes next in order of profit, bearing medium to large crops of large,

well-colored fruit. The Brockville Beauty is not as free-growing a tree as the two varieties just mentioned, but though a moderate grower, it produces immense crops of small to medium-sized fruit that takes well on the market owing to its excellent cooking qualities. The Red Astrachan is fairly productive, but owing to the defect in the tree of splitting at the crotches and unevenness in the ripening of the fruit, it has been grown to a very limited extent. The Yellow Transparent proves itself an ironclad in every respect, but owing to the fruit dropping so badly it has a very limited space in our orchards.

Of the fall and early winter varieties the standards are—Fameuse, Wealthy, Baxter or La Rue, Longfield, and McIntosh Red.

The Fameuse stands first of all in this section. The tree is a good free grower of upright to spreading habit, and bears very heavy crops of fruit, rather above medium in size, and colors almost to a crimson, bringing the highest price in our markets of any variety we have to offer of the same season.

The Wealthy ranks next in point of value. The character of the tree is somewhat similar to the Fameuse; though in some cases showing indications of blight; the fruit drops easily, and should be picked as soon as it gets color.

The Baxter is a hardy, upright grower, large, wide foliage, and bears moderate crops of large, handsome fruit.

The Longfield gives promise of becoming a very valuable variety; though inclined to over-bear, it gives a crop of medium-sized fruit that colors very well, the most of the apples having a decided blush, which, in contrast with the pure white skin, makes it appear quite handsome.

McIntosh Red seems hardy and fairly productive, but has been grown only to a limited extent in this section.

In winter fruits we have not been so fortunate in growing paying crops, though the Golden Russet, Canada Red, Pewaukee, Scott's Winter, Ben Davis, Yellow Belleflower, and Blue Pearmain are all hardy, vigorous trees.

The Golden Russet, when grown under favorable circumstances, such as thorough and continuous cultivation and liberally fed with fertilizers, will yield handsome returns, but when grown in sod it does not compare favorably with many other varieties under the same conditions, for the fruit will be small and undeveloped in color, flavor, and grain, and generally very few on a tree.

The Canada Red, though spoken of highly in some sections, proves itself a very unprofitable variety with us on account of its poor bearing qualities.

Of the other varieties mentioned the conditions are normal with the general reports from other parts of the province.

Of the two seedling apples shown on the table, I wish to draw particular attention to the one that is known in our section as the Scarlet Pippin. This apple originated in the vicinity of Brockville, and has been pretty generally planted in the counties of Leeds and Grenville. The fruit is well worthy of consideration by the Committee on New Fruits, and deserves a place in the list for judges at county agricultural fairs, as it is in good demand on the Ottawa and other markets, and is often called for by the commission merchants. The tree is an upright grower, vigorous and hardy, free from fungous diseases, and bears abundantly; season about the same as Wealthy or earlier, and the handsome color of the fruit will sell it at any time for dessert or cooking.

The large green or yellow seedling has been brought to my notice by one of my neighbors, Geo. Bowyer. He claims for it hardiness and productiveness in the tree, and exceptional keeping qualities in the fruit. He prizes it very highly as a dessert apple in May and June. Quite worthy of notice.

It is gratifying to note the readiness with which our orchards respond to cultivation, both in the growth of new wood and development of blossom buds, but where cultivation

cannot be practised owing to the spreading branches, I find that spreading swamp muck at the rate of about a load to four trees gives good results, as it keeps the ground cool and retains the moisture.

Of the insect enemies that trouble us most, I wish to speak particularly of the Cigar-shaped Case Bearer (*Coleophora Fletcherella*) that has infested our orchards of late years, causing immense damage to both trees and fruit.

In the spring of 1894 I first noticed this insect, and realizing the serious nature of the case, I devoted considerable time in carefully spraying that portion of my orchard most seriously affected. In August of that year I paid a visit to Mr. James Fletcher, Central Experimental Farm, Ottawa, and through his kindness and attention I have been able to learn the life history of the insect, and after working carefully under his wise guidance for seasons, I may say that on the whole I have made satisfactory progress in destroying it. Although this insect is not known in some parts of Ontario, it is surely working west, and it would be wise for every orchardist to read Mr. Fletcher's report on pages 201 to 206 in the Central Experimental Farm report for 1894, and be ready to battle with the first appearance of the worm. I have found the following plan of spraying to prove the most satisfactory when fighting the Case Bearer and fungi at the same time, viz :

1st. Spray copper sulphate, one to twenty-five gallons water, before buds open.

2nd. Spray Bordeaux mixture and Paris green just before blossom.

3rd. Spray kerosene emulsion, one to nine of water, immediately after spraying No. 2.

4th. Spray Bordeaux mixture and Paris green when blossom falls.

5th. Spray Bordeaux mixture and Paris green when fruit is half an inch in diameter.

6th. Spray kerosene emulsion, one to five of water about the first of October, or just about the time that young Case Bearers begin to leave the foliage and attach themselves to the twigs for winter.

I find this last spraying to prove of great advantage in reducing the number of insects that attach themselves to the twigs for winter, as I have observed in many cases that the insects do not leave the leaf, but fall with it to the ground and perish.

In the raising of plums, pears and cherries in this section there has been very little done, mostly owing to want of knowledge in varieties to plant, but I am confident from those planted that there are great possibilities before us, and in the near future I hope to be able to make a satisfactory report on these varieties.

Mr. Jones, in the course of reading his paper, said : I have had good results from spreading the barn-yard manure in February on the snow, then every year or two mulching the ground with swamp muck, about one wagon load to four trees or so, which keeps the orchard in a fine, healthy, cool condition, gives the apples a chance to attain very full size under severe drouth and keeps the sod so that you can lift it at any time with the manure fork and turn it over—in fact, the sod is half rotten all the time under this plan.

Mr. Boulter asked for a description of the Cigar-shaped Case Bearer.

Mr. Jones: It appears the latter part of August and is then less than one-sixteenth of an inch in length. This small insect pierces the leaf, and passing in between the upper and lower surface, cuts that portion of the leaf on both sides of it and comes out with a little case on it. It leaves an oblong hole in the leaf one-sixteenth of an inch in length. Then it lifts itself on its head, as it were, right up like a little cigar, and it lives upon the leaf for the balance of the season while the leaf is green, and then in the fall of the year it crawls from the leaf to the twig of the plant and attaches itself to the twig and hibernates until the following spring, when it does the damage. In the spring it works up towards the blossom bud and the leaf bud of the twig, and as soon as the growth opens the insect pierces the stem of the blossom, and that is the most serious damage to the whole crop. Then, if they are very bad, they will

nip the foliage as it comes on. After the foliage and blossoms appear, then the insects pass along on the under side of the leaf, puncturing it, drawing themselves out of their own case, and eating along the membrane of the leaf between the upper and the under coverings; and that is where the difficulty in controlling them lies. They only attack a very small outer portion of the leaf, and that is on the under side, and then they eat along the under surface. They go on eating at the leaf till the first of July, when they appear as a fly or moth again for the August egg, and the history goes round again.

Professor CRAIG: I would like to bear testimony to the good work Mr. Jones has done in the matter of the Case Bearer. It is not in my department, but I happen to know that it is through his good offices and the intelligent and persevering way in which he has carried on experiments under Mr. Fletcher's direction that the solution of the best remedy for this insect has been brought to a successful issue. Mr. Fletcher has given me a memorandum to hand to Mr. Jones on the subject, but I see that it covers practically the ground that Mr. Jones has told you, with, I think, the sole exception that in the first spraying with kerosene emulsion Mr. Fletcher recommends using that mixture diluted at the rate of one to five instead of one to nine, which is the ordinary strength, that is, if you use it before the foliage, and Mr. Fletcher is of opinion that it is advisable to do that. The ordinary Riley-Hubbard mixture is diluted one to nine, and Mr. Fletcher recommends one to five.

Mr. JONES: Though I have not seen Mr. Fletcher's report, I judge from Prof. Craig's remarks that I was to add one more spraying to my present list, making it seven instead of six, because we could not do very well without spraying No. 3—that is, spraying just before the blossom opens. That is of great advantage in controlling the insect. If we have to spray with kerosene emulsion one to five that would be the seventh spraying merely.

Professor CRAIG: No; I think it was to take the place of one of the other sprayings.

Mr. JONES: Take the place of the copper sulphate spraying in the first place?

Professor CRAIG: I should think so, although it is not expressly stated.

Mr. JONES: I may say that I did the last spraying under the belief that the leaf has served its function as lungs to the tree, and it is ready to drop at any time, so if there is any injury to the leaf at that time it is no injury to the tree. The leaf has served its function by the first of October.

Mr. ORR: Would there be any danger of the emulsion affecting the trees injuriously?

Mr. JONES: No. I was able to use the emulsion without injury, and Mr. Guinard, Mr. Fletcher's assistant, has borne me out in that more than once.

The SECRETARY: If applied too freely there is danger in the use of pure kerosene. In destroying the bark louse I used kerosene very freely, and as it was a tree I could experiment on I smothered it with kerosene and applied it two or three times, and the bark shuffled off entirely; so I think it is possible to even destroy the bark itself.

Mr. MCNEILL: The necessity of careful observation in this connection is shown by the fact that Prof. Craig noted some insect attacking the leaf of the tree somewhat similar to the Case Bearer, and he drew the attention of Prof. Fletcher, who wrote me asking me to make some notes upon it. I looked at some trees I had and found to my amazement that there was scarcely a perfect leaf on the tree—that they were burrowed much in the same way as this Cigar Case insect—and I had never noticed it. It emphasizes the necessity of fruit growers being alert in the matter of observation.

Professor CRAIG: That insect Mr. McNeill refers to is the Leaf Sewer.

EXPERIENCE IN SHIPPING APPLES TO BRITISH COLUMBIA.

Mr. BOULTER, of Picton, read the following paper :

The subject assigned to me by your Secretary is one, I think, of vast importance to the fruit growers of Ontario, and, as all of us know, prior to the constructing of the band of steel now connecting us with this far away part of our Dominion, very little was known of this province. From all we could learn it was very rich in minerals and fish, that it possessed a beautiful climate, and great has been our anticipations since it has been brought into closer connections with its sister provinces to the east.

From personal experience, I know the subject I have selected will be well criticised as many persons who have interests at stake possibly will say I am wrong in my theory in saying that I believe Ontario will have to supply all the good winter apples this province will require. On my first trip in 1887 I paid a good deal of attention to the climate and the possibilities of fruit growing there. Three thousand miles away is a long haul by rail to ship apples for profit, and as my business is directly connected with fruit growing, I having sent the first car load of canned fruits and vegetables over the Rockies *via.* C. P. R. in 1886, which proved successful ; on my second trip I was determined to see if our winter apples, once introduced, would not come into demand. I was satisfied British Columbia could grow fine plums and pears, cherries, strawberries, raspberries, and some varieties of summer apples, but all the apple trees I saw were of a scraggy nature. The nights are too cool, and the weather is not warm enough to fully mature a good winter apple. In this I was borne out by a report from a horticultural association I saw published at Victoria in August, which said that after twenty-five years of trial they could not succeed in maturing fine flavored winter apples.

Our present Governor-General is spending large sums in the Okanagan district, believing that he can succeed. However, as he has plenty of money to spend, experience will teach him later on if he can be successful. In 1893 I sent out three car loads of the choicest Spys, Baldwins, Ben Davis and a few Golden Russets I could select, paying from $2 to $2 50 per barrel for them. As it was quite late, I sent them by the southern route—the Northern Pacific. They arrived in good shape and realized a fair profit at Victoria and Vancouver, and I was wired to forward two more cars of Northern Spys, but it was too late then to send a good article.

In 1894 I was earnestly requested to ship more, but the Legislature of British Columbia in that year passed a very stringent law regarding the importation of fruit liable in any way to be infected with any pests or fungous disease, and knowing that our fruit was not wholly clean from specks or fungus, I dropped out. But several cars were shipped, and on arrival were seized, and the total contents were destroyed.

The following extract from the Horticultural Board Act of British Columbia will explain :

Inspection of Imported Fruit.

"6. All importers of fruit must give notice to a member of the Board of Horticulture, or his agent, or the Inspector of Fruit Pests, upon the arrival of any and all shipments of fruit ; and all fruit and fruit packages imported into this province shall be inspected, and if found to be free from insect pests and fungous disease a clean certificate shall be issued therefor in conformity with the Rules and Regulations of the Provincial Board of Horticulture : Provided, however, that no fruit or fruit packages imported into this Province shall be removed from any dock, wharf, mole or station where such fruit and fruit packages have been landed before inspection and such clean certificate thereof shall have been obtained, and all such fruit and fruit packages as may be found infested with any insect pest or fungous disease shall be either destroyed by the importers thereof by such process as any member of this Board, the Inspector of Fruit Pests, or any agent appointed by this Board may direct, or shall be re-shipped by the importers thereof to the country from whence such infested fruit was exported.

Inspection of Imported and Home-grown Fruit.

"7. All fruit, whether imported or grown in this province, or exposed for sale, shall be subject to inspection under the authority of this Board, and if found to be infected with any injurious insect pest or the larva thereof, shall be quarantined or may be destroyed at the expense of the owner of said fruit by such methods as this Board or its agents may direct.

Stencilling and Labelling.

"8. All persons shipping, sending, or delivering any fruit, fruit trees, scions, cuttings, or plants within the province shall place upon or securely attach to each box, crate, or other package or parcel containing the same, a distinct stamp, mark, or label showing the name of the producer and shipper or sender, and the locality where grown, but boxes and barrels containing fruit shall be stencilled or stamped with letters not less than three-quarters of an inch in length."

On my annual trip this year, from all I could learn, the apples sent in 1894 were not fit to be shipped to any place, many of them being a small, miserable, scabby lot, full of codling moths, etc., and I did not wonder at the authorities in refusing to allow them to remain in the country. However, I refused to attempt this year to ship any, although promised a good price, as, from all I could learn, a few apples if found with any fungous disease would condemn the whole car load. Now, what is best to do? I noticed that all the apples at Victoria, coming from Oregon and Missouri, were packed in boxes of about fifty pounds each, and they can be easily inspected. I sent out some fine Spys to the several wholesale houses in this way, along with canned goods, to test them, and being carefully selected they passed through.

I believe a good trade can be successfully worked up by packing in this way, using the utmost care. Will it pay? Yes, I think it will. Freight will be lower, as more can be shipped in a car than in barrels, and unless the duty is removed I think money can be made in shipping apples to British Columbia. They must have our apples, as the Missouri, Oregon and Washington apples do not compare with them.

Mr. BOULTER added that he believed there was a good market for Ontario apples in Prince Edward Island, but the apples must be put up right, and he thought a good demand could be created.

Mr. CASTON: What does it cost per barrel to ship to British Columbia?

Mr. BOULTER: I used to pay $1.10 per hundred pounds, one hundred and fifty pounds to the barrel. You can calculate about a cent a pound on apples.

Mr. SMITH: I would like to know how British Columbia happened to get such good Russets and Spitzenbergs and Baldwins as they had in Chicago at the World's Fair.

The SECRETARY: Yellow Belleflower also. The Spitzenbergs were finer than we have ever grown in Ontario.

Mr. BOULTER: I don't say that they cannot grow a winter apple in British Columbia; possibly they can in some very favored localities. I am speaking generally of the Province of British Columbia, and I am satisfied the climate is not right for growing apples.

The SECRETARY: Do I understand you to say it is because they do not grow vigorous trees they cannot produce the quantity they require?

Mr. BOULTER: Yes, partly that. Their trees are not vigorous growers, and I claim that a tree that is not vigorous growing tree never can produce first-class fruit.

Mr. HUTT: Is not their fruit much larger than ours?

Mr. BOULTER: It may be larger. They might pick out some very large apples and send to the World's Fair. Although they may have sent some to the World's Fair from some favored locality we will have to supply winter apples to British Columbia. Where you cannot grow real good corn you cannot grow good winter apples, and in British Columbia you cannot grow good corn.

Mr. RACE: This report we have received from Mr. Boulter seems to be very contradictory of a report we got two years ago from Chicago, which led us to believe that the Ontario fruit grower was in a very few years going to meet with very keen competition in the North-west and from British Columbia. According to Mr. Boulter we have nothing to fear at all from the competition likely to come from the Pacific Coast. Which of this reports are we to believe? If Mr. Boulter's paper is correct it is certainly encouraging to the Ontario fruit growers; but if the reports of two years ago that were given to us very largely by our own representatives in Chicago are correct, the apple of British Columbia is going to be a very strong competitor of the Ontario apple.

The SECRETARY: I think Mr. Pettit and Mr. Craig who are present will bear me out in saying that the beautiful pears and apples that were shown from British Columbia excelled any we had on exhibition at Chicago. It is very possible that in the parts Mr. Boulter has visited in British Columbia the apple does not succeed; but there must be some parts, though they may be very limited where it does grow to great perfection.

Prof. CRAIG: I was very much interested in Mr. Boulter's discussion, not only on general principles but on account of reference to the Experimemtal Farm—which, however, had nothing to do with the passing of the law restricting fruit which is infested by insects or fungi from going into British Columbia. We should consider first that British Columbia has a very diversified climate. You will find greater variations within shorter distances. On the lower part of our Experimental Farm at Agassiz we could not grow apples, but on the higher lands we could grow them to perfection, and we show you samples from there. A few days ago a gentleman at Linton sent me half a dozen varieties of apples grown on his farm, and I brought them along. In regard to insects, there is one thing that the fruit growers of British Columbia have not to contend with,—they have no codling moth in that province. You may just consider what that would be worth to you, and what you would do to get rid of it. I think they are justified in exercising every precaution possible to keep injurious insects out of the province. Neither have they any San Jose scale; and they are trying their best to keep their orchards clear from these pests, and they pay an inspector $1,500 per year for that purpose. These specimens of apples I have here were grown by irrigation, and these are the districts where they are going to grow the finest fruit. In the coast regions they cannot produce apples of the finest quality, but in the interior regions where they have a much drier atmosphere and good soil and where they are able to irrigate, and also in other districts where they have just the amount of moisture with more cold, they can produce apples of fine quality and appearance.

Mr. CASTON: It seems as if the coast climate of British Columbia resembles very much the climate of Britain, and we do not find that they produce any long-keeping apples there.

Mr. RICE: But I must acknowledge to you to-day that I never saw a finer exhibit of apples than you are showing here; and in our market at Port Huron we have no apples this year; we have had to have our apples shipped in. We had some very fine, large, beautiful red apples, selling at $1.75 per barrel. At the same time our buyers were begging for Greenings grown below Toronto somewhere—they did not know where, but on Canadian soil—and paying at wholesale $3.25 per barrel—(Hear, hear). I never saw such Greenings anywhere in the world; and I thought then of what was said at one Canadian horticultural meeting,—"What will we do with the Rhode Island Greening? They are forced on to us; the tree men are making us grow it here in Canada, and it brings such a low price?" They decided that the only way was to refuse to buy it. What if you had refused to buy it when it brings such prices now?

Mr. A. H. PETTIT: I have never been to British Columbia to see the different parts where fruit is grown, but at the World's Fair we certainly had a beautiful exhibition of apples from that country of very large size, fine color and good quality. Yet, from what I could learn, I look upon that country as likely to be quite a market for Canadian apples; and why? Because their apples grow to enormous size, and are not of that keeping quality that we grow in the more northerly section of the country. The farther north you can grow an apple, if it is the home of that apple, the better keeping qualities

it possesses, and thus we will lengthen out the fruit season and give them a fruit of equal quality with their own, though perhaps not of that enormous size. At that exhibition there was a rivalry between the different states of the Union and the provinces of Canada as to which could show the biggest apple. I do not know which came out ahead, but they were of enormous size. The State of Idaho, under a system of irrigation, produces apples of enormous size and very high color indeed, but I do not think that class of fruit has the keeping quality that fruit has when grown in the more northerly portions of Ontario.

Mr. BEADLE: Do those apples have the same high flavor that our apples have that are grown in the northern climate?

Mr. PETTIT: No, I do not think so; neither do I think that our overgrown apples have. It is the medium size and color that gives you the quality in all cases.

Mr. DEMPSEY: I had the pleasure of comparing a sample of the Hastings apple that was grown in British Columbia this year, and I could not detect any difference between it and the apple grown on my place; the flavor was equally as good, though not so highly colored.

Prof. CRAIG: That was grown at Agassiz.

The Secretary introduced Mr. HASKINS, of Hamilton, who made a few remarks, saying he had not been able to give the question of fruit growing the consideration that he used to in olden times.

The meeting adjourned at 12.30 until 2 o'clock.

FIRST DAY—AFTERNOON SESSION.

The SECRETARY read a letter from the Michigan Horticultural Society, appointing Messrs. Taft, Watkins and Rice as delegates to this meeting. He moved that these gentlemen be invited to take part in all our discussions.

Mr. MCNEILL seconded the motion cordially, as he had frequently enjoyed the hospitality of the Michigan fruit growers, and nowhere did he find a warmer welcome than in Michigan.

The motion was enthusiastically carried.

QUESTION DRAWER.

The Secretary read question No. 3 as follows: "How can the grape and rose thrip be destroyed?" and read a letter from Prof. Fletcher as follows:

"I notice among the subjects suggested for discussion at the Woodstock meeting question 3: *How can the grape and rose thrip be destroyed?*" I have had a good deal of experience during the past eight years with both of these insects. I have had no trouble in controlling either with the kerosene emulsion made by the Riley-Hubbard formula (two gallons kerosene oil and one gallon of soapsuds, containing one-half pound of soap) reduced with nine parts of water. If this mixture be sprayed forcibly through vines on trellises or into rose bushes at the time the insects are in the nymph condition it is a sure remedy. When the leaf-hoppers have acquired their wings two or three applications are necessary."

Mr. MCNEILL: The rose thrip has begun to be a serious pest. I would like to hear about it from Mr. Orr.

Mr. ORR: The thrip has been troubling us a good deal for many years, but very much worse this year than in previous ones. About eight acres of grapes that I have were badly infested with them this year. The difficulty in treating the thrip is that they work entirely on the under side of the leaf. I understand that treating them with

a preparation of tobacco water or with the coal-oil emulsion is effectual in destroying them, but I have done nothing in that direction yet at all, from the fact that it seems almost impossible to reach them, and I would like very much to get some other opinion on the matter.

The SECRETARY: Mr. Fletcher said on two occasions in writing to me that he had no difficulty in destroying it with two or three applications of the kerosene emulsion.

Mr. MCNEILL: If it continues to increase it will be a very serious pest, but three applications is more than we could hope to give with profit at the present prices of grapes. I was hoping that we could learn how to knock it out with one application, or attack it at a certain period of its growth when we could get rid of it with very little trouble.

The SECRETARY read the question: "Are apple storehouses desirable for Canadian growers?"

Mr. DEMPSEY: I think it is desirable for any man that is producing from 500 barrels up to have an apple house. No one can understand the benefit to be derived from an apple house unless he has had one. It is very convenient to place the fruit in, and you are not compelled to sell the fruit right away; whereas, without a fruit house, you are often compelled to sell when prices are rather low. Keep them a month or so and you will nearly double your money. You can keep until April apples that are usually placed on the market say the fore part of January. Last winter from my fruit house I shipped on the first day of April to England Spys, Seek-no Furthers and many other varieties.

OUR FRUIT EXHIBITIONS, AND HOW TO MAKE THEM EDUCATIVE.

Mr. R. B. THORNTON, of Woodstock, read the following paper:

Although fruit growing is recognized as one of the most important branches of agriculture, yet no other industry is pursued with less intelligence by the great majority engaged in it. I refer more particularly to our farmers and their orchards than to the comparatively few fruit growers who have entered into the business for pecuniary gain or pleasure.

For proof, ask the army of agents who annually canvass the country for orders, how many men do they find who select stock, plant, prune, cultivate and care for their orchards and gardens in such a way as to make the enterprise every way successful and profitable. Or ask the fruit packers what percentage of the orchards are inviting to the shipper. Or ask the grower himself the names of the different varieties grown by him, and how few can give the names correctly.

The reasons for such a state of ignorance are obvious: 1st. Such a long time intervenes between planting and abundant bearing that if a mistake be made in planting it will be too expensive to attempt a remedy when your orchard reaches maturity. 2nd. Very few record the names of their trees when planting or can remember the names till bearing. 3rd. New and untried varieties are being pushed so hard by enterprising nurserymen that instead of promoting the interest of fruit culture the result is in most cases attended with disappointment, failure and discouragement.

Again, if you attend our local agricultural fairs and carefully study the fruit department year after year, you will agree with me, either that the various boards of directors have got into a rut, or else that fruit growing has reached the limit of its possibilities.

I believe in the exhibition of fruit, in giving prizes and in making the competition as keen as possible between growers if you would stimulate to success; but I do not believe that it conduces to the attainment of any of these objects to find a man on guard whose duty consists, not in describing, naming and showing the merits of new fruits, but

in guarding the fruit with a long stick, or giving you a hint to move on. I fear that very many exhibit fruit more for the sake of the paltry prize of fifty or twenty-five cents than because they have entered a contest in which forethought, science and skill combine with nature to win praise, admiration and success.

To make an exhibition of fruit educative I would suggest the following:

1st. Revise the prize list by leaving out such kinds as do not possess sufficient merit to deserve general cultivation in that particular district.

2nd. Print in the prize list opposite the name of each kind of fruit a score of merit marks as at present accepted by the Provincial Association of Fruit Growers, basing the award of prizes upon this score.

3rd. Distinguish in the list between summer, fall and winter varieties, and keep them separate on the exhibition tables.

4th. Give exhibitors the option of any six varieties out of the total list of old kinds, subject to the score as printed in the prize list, at the same time increase the value of the prizes for first, second and third in said groups.

5th. Attach a printed label to each plate of fruit in type large enough to be read outside the guard rail.

6th. Engage one qualified judge, who alone will be responsible for the way prizes are given. Pay him for his time and require him to remain with the fruit each day until the close of the fair; to answer questions and give such information as may be required.

7th. Let the Provincial Association request the Government, through the Minister of Agriculture, to send an expert judge of fruit to at least one fall fair in each county annually until each society in turn shall have the benefit of his knowledge and judgment.

8th. Add the names of such new varieties of fruit each year to prize list as shall in the judgment of the Provincial Association deserve a place in the list.

9th. Offer special prizes for new varieties not on the list which are accompanied by a description of their respective merits. The kind of soil where grown, age of tree, or anything else that may entitle it to favorable consideration.

The SECRETARY: I would like to emphasize the point in regard to labelling. One of the difficulties which visitors to many fairs have is to find what the varieties are. They will strain their eyes and necks and with the greatest difficulty try to decipher some very poorly-written names attached to the fruit, and possibly fail after all to make out what they are. One of the benefits of visiting these fairs is to ask about new varieties and become acquainted with them. Therefore some plan should be found by which fruit would be labelled with printed names elevated in such a way that they could be read by every passer-by. I think we should keep very clearly in mind that the object of fairs is educative, to give information, and therefore there should be somebody on hand to answer the questions of visitors in regard to the exhibits in the room.

Mr. BOULTER: At our meeting last night steps were taken that will lead to proper persons being selected as judges at these fairs. Usually some straight-laced fellow is put in charge of the exhibit, whose whole object seems to be to keep visitors moving on. There is no information given at all, and persons are allowed to look only about five minutes before they are asked to move on. Experts should be appointed who could give information. A committee has been appointed to select good judges and recommend them to the Toronto, Ottawa and London exhibitions, and perhaps these recommendations will be extended later on.

Mr. MORDEN: There is a matter that ought to be touched upon more fully, namely, the disappointment that arises from sending out high-priced, highly lauded varieties. We find that people with small lots in towns have them filled up with material that is of no use, and that is taking the place of something that will produce fruit. Farmers are planting new things, unknown, untested, probably good for nothing. At the Nurserymen's Convention at Niagara Falls, N. Y., I urged that no new fruit should be sent out until it had been tested at a large number of independent stations, and if it had merit the orig-

inator would get a free advertisement. It would become known through the whole country that it was a good fruit. If it was good for nothing it would end there; and that is the way it should be. Instead of that our nurserymen are trying to get hold of a wonderful novelty. They can make novelties to order out of any old variety; and the largest nurserymen are sometimes the largest offenders. They send out a hundred agents, each of whom is instructed to push this variety, and it is pushed on to every farmer, and ninety-nine times out of one hundred it produces nothing, and it is taking the place of something that would produce fruit. We had a very close vote in the Nurserymen's Convention, but I found it a failure to get a vote there. I asked, too, that the nurserymen's catalogues as issued should be a reliable guide. We find that fruit is described in the flaming colors of the originator. You will find the champion grape described as of excellent quality, and all that sort of thing. This Association should demand that catalogues should be reliable. It is certainly very discouraging to every planter to get varieties that are worthless; and a great proportion of this high-priced stuff is not worth planting at all.

Mr. SMITH: I think that planters are a good deal to blame themselves in not informing themselves in regard to varieties that are adapted to their locality, and for taking the word of every travelling agent that comes along. I should think by this time that a good many of them would begin to learn that it is not all gospel that the tree agent talks to them. I think we are making a step in advance in this direction. If local organizations, such as the Society here, would take pains to have their exhibit correctly named, it would be a step in an educative line as suggested by the paper.

Mr. MCNEILL: The Government think so much of our bodily health that they license doctors for fear we will not know enough to get the right man to cure our bodily ills; they think so much of our pockets that they will not allow an auctioner to sell stuff unless he is authorized by license. That is paternalism in a mild form. It has always been so, and we get used to it. Still they allow men who want agents at three dollars a day to advertise that "no experience is required." (Hear, hear, and laughter.) And it appears to me that it would be a step in the right direction to have fruit men licensed. I believe that the business then would rise to a dignity that it has not now. (Hear, hear). I have leisure sometimes, and could probably make an honest dollar by selling fruit, but I am ashamed to appear as a tree agent. (Laughter). If I paid a license and could reply upon my respectabilty and have something to show for it, I believe that I might do something in that line. Seriously, I believe it would be a step in the right direction to protect the farmers and those who are not informed and that cannot reasonably get themselves informed upon varieties, by seeing that only men who are responsible should be allowed to sell tnese things Stockmen are now seeing that horses are licensed, and in every way they are protecting those who cannot reasonably inform themselves on these subjects; and why should the country be flooded with tree agents that are parasites, and that keep respectable men out of the business? (Applause).

Mr. SMITH That plan is adopted in some western states.

Mr RICE: The trouble with us in Michigan is that we allow anybody that has a good tongue to talk and lots of brass in his face to go out and beat the poor man, and the consequence is they drive respectable men out of the business. It is the fault of nurserymen. I was riding with one of the leading nurserymen of Rochester, N. Y., and I said to him, "Mr. B——, do you instruct your agents to recommend the Russian Mulberry to people through the country?" "Mr. Rice, we sell just what people want. That is our business." "Mr. B——, how would people know that they wanted the Russian Mulberry if your agents did not tell them so?" Still the answer was, "we raise and sell what people want." I asked him the question in another form. He says, "Mr. Rice, let us talk about something else." (Laughter). Now, it is the money that is in these things that makes the nurserymen take this course. They will put a novelty on. They will say to a man, "go and I will give you so much a day." The tree will cost him perhaps ten cents or five cents. He reasons—he does not tell the man so—"you sell that variety; you tell them it is something new and here is a flaming picture of it, and it is nicely described; tell them there was nothing like it ever grown in the world before and it will

bear the next year after you set it out—(Laughter)—and not only that, but it is the most beautiful tree next to the Tree of Life almost, and fair to look upon, and everything and you ask $1.50 for that tree." Now then, you see if this man gulls three men in a day he more than pays his wages; whatever else he does is clear profit. So that by making a specialty of that kind they can afford to pay good wages to anybody that has got a voluble tongue and a brassy face.

Mr. A. H. PETTIT: I do not think at the present time we suffer to the extent that we did a few years ago with this tree agent business in this country. I think that our farmers and fruit growers, as a rule, have become very much better posted than they were in the early days of this work, and, no doubt, in the early history many mistakes were made. We have been discussing this question for years as a Fruit Growers' Association, and we appealed to the Government for a grant along that line to establish throughout the province at suitable points, and to represent certain localities, fruit experiment stations, where all the new kinds of fruit recommended by these people for cultivation will be thoroughly tested and reported upon, in order that every information can be given to the people in advance as far as it is possible to do so. These stations are doing most excellent work, and the work is coming on as rapidly as it possibly can. Another effort we are making is to have at the great Industrial Exhibition at Toronto, where the largest possible number of people attend, an exhibit of the large variety of fruits the stations are testing, and give all the information we can as to the hardiness, productiveness and good quality of such varieties as are placed before our people to plant, and therefore to buy. I think this difficulty will be overcome in a very few years. I think the evil will cure itself very rapidly. Another point is in regard to cultivation. I think horticulture is as fairly and well done throughout Ontario as any other branch of agriculture. It is becoming better and better every day, and travel where you will to-day you will see many samples of orchards that are well cultivated, well pruned and very well cared for. (Cheers.)

Mr. WATKINS, of Michigan: I think the manner of handling the tree list by our Society is a good one. Every year we have a complete list of everything that is worthy of cultivation, and some that are not. We have a committee that revises that list every year. If a variety should become unworthy of cultivation, it is struck out. New ones that are tested at our sub-station, under the careful supervision of President Lyon, are put on the list, and that revised list is a very valuable feature. Our list of apple trees in trial now is nearly 300, and there are two trees of each variety, and they are fruited right along from year to year until they become what you might call standard.

Mr. RACE: We have not heard anything at all from any local men.

Mr. T. H. PARKER, President of the Woodstock Horticultural Society: Our local association undertook to correct the names of much fruit that they believed was improperly named. They sent for Mr. A. McD. Allan, who was experienced in that line, and he spent a day or two here and also visited St. Thomas and Ingersoll, and I was with him at some of these places, and it was really amusing to see the strange names that some of these apples had, and many of them were wrongly named. The thing was not followed up, and I do not suppose that much benefit was derived from that single visit. It seems to me that the matter rests a good deal with the local societies. If they were willing to expend a few dollars in engaging an expert to attend their fairs and act as a judge and correct the names of these fruits, it might be a very great benefit to the country generally.

Mr. LEITH, Woodstock: I think very often mistakes are made in the placing of labels on apples at all, because they are not true to the names placed on them. I have made it a point to get the proper names of certain trees in my own orchard that may be starting to bear, and when I go to an exhibition, or a display like the one you have here, I look very carefully at labels on fruit, supposing they are placed there by men who ought to know, and I go away with the impression that I have got the correct name, but sometimes I find afterwards that it was not the correct name.

I am sure the great majority of people who go to our agricultural shows pay very little attention to getting information from the displays of fruit, and anything that will give them the correct names of certain fruit, I think, would be desirable.

Mr. THORNTON: I have attended a large number of local fairs in this county, both this year and last, and know of only one fair in Oxford county where they labelled the fruit. That was at Embro; and the thought struck me that the idea should be embodied in every exhibition throughout the Province. Hence I wrote this paper. I believe it would do a great deal in educating the people in regard to fruits. I know there is a very general ignorance by fruit growers as to the names of their fruits. They may know what pleases them and what gives them satisfactory returns in their own orchards, but they do not know what would be the most profitable to grow for market, beeause they are not generally sufficiently well informed. In attending some of our own local fairs, I noticed many fruits exhibited that were wrongly named, and I also noticed that many judges knew absolutely nothing about it, except a few varieties. Last year at a very important fair in our county the first prize for Baldwins was given to a collection of Spitzenbergs. (Laughter.) This year at one of our fairs the judge said, as he passed around (I was standing near by): "I don't know anything about pears; I will just award prizes according to their appearance;" and he passed on the whole in that manner. I suppose people who received the prizes went away with the idea that their particular fruit was the best on exhibition; and some of them were incorrectly named, and yet they obtained the prize.

The SECRETARY: We were up at Clarksburg not long ago, and a gentleman showed us a very fine tree of pears, and he said: "You see what fine Louise Bonne pears we have here." I said: "Those are Clairgeau." He said: "That can't be; they have taken the prize for Louise Bonne at the exhibition here for years."

Mr. RICE: You conduct your exhibitions here very different from what we do. With us, if you can't read the label plainly, you can take it up and handle it, and nobody will find any fault. A man will walk along and have a little word with you, and there is nothing said to hurt your feelings, or anything of the kind. I visited your fair in London and never saw such a beautiful display of fruit, but there was scarcely a name I could see. I put my hand down to pick up a label and heard a loud voice say: "Hands off!" I was frightened. Everybody was looking at me. Up above everybody stood a man with an eagle eye watching. I did not know what to do I went to one of the directors and I said: "My dear sir, I am from the United States, and I want to look at your fruit; I wish you would tell that man up there not to shout at me again—he frightens me." (Laughter.) He called up and said: "Let this man look at anything he wants to." I went around then and spent two hours looking over the fruit, and I then found out that when the man shouted "Hands off!" he had no reference to me. (Laughter.) If you could have more confidence in each other, it would be better. Don't be so dishonest among your neighbors so that nobody can trust you—(Laughter)—and do be more honest among yourselves, and tell yourself that you won't steal anything, and let your neighbor find that out, too, and then when you go in to look over this fruit you will have a great deal better chance. (Hear, hear.)

Mr. MCNEILL: That is the John Bull of it. Down at Montreal some of the finest grounds are enclosed with walls of stone six feet high, and I felt like getting dynamite and blowing them down. Whenever you see that big six foot wall you may know it is some hard-headed fellow from England or Scotland.

Mr. WATKINS: We have taken down all our yard fences and opened the street. (Hear, hear).

Mr. MORDEN: That is what we do at Niagara Falls, Canada, too, in addition to those things mentioned by Mr. Thornton.

Prof. CRAIG: There are one or two other ways in which you can obtain the names of your varieties—because that is one of the most important features along the educative side, of value in our fall exhibitions. You have your provincial society here, the pre-

sident and secretary of which are experts; then you have at Guelph a horticultural division with Mr. Hutt as professor of horticulture, who will always be glad to identify specimens for you as far as he can if sent to him; and lastly at Ottawa you have an institution that is willing as far as possible to aid in this work, and any specimens you may send to me as horticulturist of the Experimental Farm I shall be very pleased to examine as fully and as far as my other duties allow me. You may send specimens free to the Experimental Farm. Then you have an important committee in connection with this Association that is doing excellent work—the Committee on New Fruits, of which Dr. Beadle is chairman, whose duty is to investigate the merits of all seedlings and fruits without name, including new varieties to be put upon the market. Now if you will send samples to me at Ottawa I shall forward them after examination to Dr. Beadle and to Mr. McD. Allan, who is also a member of that committee and our combined observations are presented at the annual meeting. We are thus able in a measure to keep track of new varieties.

A Delegate: Would you send one apple or two or three?

Prof. Craig: It is always better to send four or five specimens, because it is very difficult to get one apple that is exactly representative of its type. If you have five or six, then I can send one to Dr. Beadle and one to Mr. Allan, so that we can make our report much more conclusive and valuable. I trust that you will bear in mind these suggestions and act upon them.

THE BLOOMING PERIOD OF FRUIT TREES.

Prof. Craig: Those who attended the meeting at Orillia, will remember a very excellent paper we had from Professor Beach from the Experiment Station at Geneva, N.Y. He gave us some very valuable information in regard to the blossoms of fruit trees, and the power of the blossoms of the different varieties of grape vines to fertilize themselves and so set fruit. This investigation was instituted by Professor Waite of the United States Department of Agriculture at Washington. Mr. Waite worked on pears, and the results of his researches opened up a very wide field for investigation, and it was somewhat in extension of that work that I began work on the apple blossom I may say, however, that the work was begun previous to this season. My object at this time is to present to you in a very crude, but I hope suggestive way the results of these investigations, more for the purpose of asking your co-operation and for getting the fruit growers of this province thinking about this matter, than to give you very valuable information at this time—though I think there are some points that will be of interest and value to you.

NOTES ON THE BLOSSOMING OF FRUIT TREES IN CANADA.

By John Craig, Horticulturist, Central Experimental Farm, Ottawa.

The cause of the unfruitfulness of orchards has always at horticultural conventions and elsewhere been prolific of much surmise, conjecture and I may say variation of opinion. The possibility of the trouble existing at least in part in the blossom has been mooted only in recent years. As a rule, I think we are prone to lay too much stress upon a single feature in the management of an orchard, and too little upon the collateral practices which make a harmonious and well balanced programme in the life of the average apple orchard. Some orchardists pin their faith to varieties, others to location and cultivation, others again to manuring or pruning, and perhaps still others—though I have not yet heard of them—to spraying. Undoubtedly we cannot expect orchards in which the trees are so closely planted as to be fighting for the mutual ground and perhaps for nourishment at twenty years of age to continue long and of healthy and fruitful condition. In passing, I may say that in certain localities with certain varieties

close planting is desirable and may be practiced with profit, but this is the exception. Nor is it reasonable to expect trees to continue to yield profitable crops of apples year after year, when year after year we are taking away from the soil and putting nothing back.

But granted that the trees are planted at the proper distances apart, that they are cultivated, pruned and manured reasonably and rationally, we do not in most cases reap entire success unless the previous good treatment has been followed up by judicious and well directed efforts, having in view the destruction of injurious and noxious insects. There are instances on record where even after all this labor and all these various precautions have been taken that the orchard still remains obdurate and refuses to bear defying all attempts to coax it into fruitfulness. One says root prune to stop superabundant growth; another says top prune to let in the light; another says give manure to stimulate; another, seed down to check growth; and still another, spray to induce fruitfulness. All these councillors may have been listened to, their advice acted upon, but still without success. We then begin to observe the conditions which surround orchards of a similar character. As a rule these observations lead to the conclusion that orchards made of varieties intermingled are more fruitful than those in which the varieties are separated and planted in large blocks. Professor Beach, in his admirable address on this subject, before the Association at Orillia last year, cited a remarkable instance of this kind. The orchard was made up in part of Baldwins and of Greenings planted in blocks and in part of Baldwins and Greenings mingled with other varieties.

Where the two varieties mentioned were planted in blocks unmixed with other kinds they were unfruitful, but when mingled with other varieties the converse was true. This points at least to partial infertility of the blossom with its own pollen and points to the desirability of intermingling varieties in the orchard. In the case of certain varieties of American plums this belief has prevailed for some time and no doubt is well founded. The valuable investigations of Professors Beach and Waite upon grapes and pears clearly set forth a similar condition of affairs in the case of these fruits. Similar experiments with apples have been commenced at Ottawa, but need further confirmation before they can be announced with authority. In connection with these experiments an attempt has been made to secure records of the blossoming period of the different classes of fruits in the Dominion. To obtain such a record was only possible to the kind co-operation of the fruit-growers of Canada. It gives me pleasure to acknowledge the hearty and kind manner in which they have aided me in this work. The weather was most unfavorable, however, for obtaining records which could be considered representative of normal seasons. We all remember the extreme heat of early spring which hastily awakened our fruit trees into blossoming activity, having finally the effect of crowding the whole blossoming period in some districts at least, into the compass of a few days. This so disturbed the natural blossoming periods of all fruits as to render the records only relatively correct, both as to periodic difference between varieties and the annual date of occurrence. Before going into the remainder of the subject, it might be interesting to us for a moment to look at the construction of the normal apple blossom.

The Apple Blossom.

The apple blossom exhibits a characteristic peculiar to the pomaceous division of the rose family. On making a vertical section of an apple blossom we find the organs composing it to be arranged as follows, beginning at the outside, first, a calyx or enveloping and protecting sheath composed of five parts called sepals; second, the delicately coloured corolla, also of five parts called petals. These two series serve to protect the delicate organs within from heat and cold and also attract to the blossom insects which play an important part in the distribution of pollen. The stamens or pollen-bearing organs, fifteen to twenty in number, are arranged next in order on the top of the closed receptacle. In the centre are found the pistils or carpels, five in number and corresponding to the five divisions in the core of an apple. An elementary knowledge of the parts

of the blossom is essential to the intelligent application of the best practices in orcharding.

To return again to our records, observations covering a great many points from Prince Edward Island to British Columbia were made. These are in no slight degree interesting, merely from the standpoint of statistical record, showing as they do the great climatic variation discovered in travelling from west to east. If it is imperative to the fullest success that varieties should be intermingled, then we should know the most suitable varieties to plant adjacent to each other, and this we can only ascertain by accurate observations extending over several seasons. These records also impress us with a fuller knowledge of the climatic variation found in the comparatively limited area of the fruit belt of Ontario. We find that Red Astrachan came into bloom at Windsor on May 3rd, South Niagara on the 8th, Burlington on May 10th, Lindsay on the 12th, and Ottawa on the 15th May. Northern Spy opened its flowers at Windsor on May 8th, South Niagara on May 10th, Burlington on May 20th, Lindsay on 16th and Ottawa on the 24th, being a difference of twelve days in one case and sixteen in the other. These two varieties also illustrate the comparatively wide differences in the habits of trees with regard to their blossoming periods. The difference would be much more strongly marked did Red Astrachan bloom with the earliest of its class. As a preliminary result of these investigations the following groups may be arranged according to the dates on which they were in full bloom :

1.—Earliest Group—Duchess, Fameuse, McIntosh Red, Ben Davis.

2.—Middle Group } Baldwin, Golden Russet, Wealthy, Wagener, Yellow Transparent and Astrachan.

3.—Last Group } Alexander, Maiden's Blush, Northern Spy, Ribston Pippin, Roxborough Russet, Talman Sweet.

The pears easily fall into two groups as recorded the past season. It is probable that during the normal season the blossoming period of some will be much longer and probably considerably modified in many cases. They stand this year as follows :

1.—First Group—Howell, Keifer, Seckel, Sheldon, Anjou.

2.—Second Group—Bartlett, Clapp, Duchess, Flemish Beauty.

Plums.

1.—First Group—Burbank, Duane's Purple, Lombard, Bradshaw.

2.—Second Group—German Prune, Imperial Gage, Moore's Arctic, Reine Claude.

Cherries.

In Ontario there was practically no difference in the blossoming period of different varieties last season.

These notes are offered only in a suggestive way to horticultural observers who may be and I may say should be interested in this subject. Success will come to the fruit grower of the present and of the future very much in the proportion in which hard thinking enters into the details of horticultural operations. Allow me to submit this subject as one of the details which will bear some thinking and upon which I make bold to ask the co-operation of my friends, the practical fruit growers of Ontario.

Mr. J. B. Hall, of Woodstock : Is there any way in which we can assist in fertilizing the various kinds of fruit—whether we can do it by insects or otherwise? If by insects, what is the most useful and least expensive and troublesome?

Prof. Craig : The paper I have just presented is an endeavor to get over some difficulties in that way. By intermingling the varieties which blossom about the same time nature will do the work, but to those of us who have orchards or blocks of single varieties and do not find them profitable I would advise the keeping of bees or the top-grafting of certain varieties with others which bloom at the same time.

Mr. BEADLE: Advise both keeping bees and grafting too, otherwise they may not get the pollen.

Mr. HALL: Are the bees a blessing or a curse?

Prof. CRAIG: I am sorry we have not that eminent defender of bees, Mr. Holtermann, here, who conducts the department in the *Horticulturist*. I think he could defend the bee much more ably than I can, but I have not one iota of hesitation in saying that the bee is a great blessing to the fruit grower. (Hear, hear.)

Mr. RACE: It depends somewhat on the end you are fooling with. (Laughter.)

Prof. CRAIG: I have even known cases when men fooled with the business end of a bee that it proved a blessing. (Laughter.) I know that there have been statements made to the effect that bees injure grapes, but I don't think they are well founded. I think in every case that has been investigated it was found that the grapes had already burst, and the bees simply visited the grapes to extract some grape sugar and grape juice; they are not provided with the kind of weapons to break the skins.

Mr. GEORGE BLAKE: What benefit to the fruit growers is this cross-fertilization? Would it be a benefit to the apple grown from this blossom, or would you get the benefit from the offspring raised from the seed?

Prof. CRAIG: Well fertilized apple blossoms mean usually well developed apples. In case the fruit did not set of itself this year, then you would get the benefit this year, but where your apples fruit freely then there is no necessity for further fertilization. I may say that no actual change takes place in the product of this year—that is, the fruit is not modified to any extent by the pollen which may be carried from another tree.

Mr. BLAKE: It seems to me this is splitting hairs. It does not benefit us fruit growers. Now the practical benefits to fruit men I want to see brought out clearly. In raising fruit we have got to go back to the grafting system; we cannot depend on that fertilized offspring, and we lose the benefit of this cross-fertilization.

Prof. CRAIG: No, sir; allow me to explain. If you want to get a new variety it must be done through cross-fertilization; if you want to multiply that variety it is done through grafting or budding.

Mr. BLAKE: As practical fruit raisers we do not want to raise new varieties; we want to get the benefit of cross-fertilization in the present crop of apples. Does it do us any good?

Prof. CRAIG: Certainly, in a case where a variety has not sufficient pollen.

Mr. BLAKE: Our orchards are deteriorating and our fruits are not what they used to be, so if we can benefit the present generation I shall be glad. I have been in the fruit business for years. I have made a great many mistakes. If I had had the experience I have to-day I might have been thousands of dollars in pocket. My first mistake was to go into too many varieties. I have been grafting and budding and experimenting all my life. If I had just gone into two or three main varieties I would have been very successful, but I have not made it a very paying business.

The SECRETARY: Have you not some varieties that do not bear very well?

Mr. BLAKE: Yes.

The SECRETARY: Mr. Craig has explained that if you want them to bear you should plant some other variety near them.

Mr. BLAKE: If I had gone into Kings and Baldwins thirty years ago I would have been independent to-day.

Mr. SHORT (Calgary): I would like to ask Prof. Craig if he has run across any varieties of apples, pear, plum or cherry that we will grow in Southern Alberta, south of Calgary, in a dry section where we have to irrigate.

Prof. CRAIG: We have had no success in any portion of the North-West Territories in growing apples. I have had one specimen sent from Prince Albert last year—a specimen of Whitney Crab—which in that section was considered a great curiosity. I know

Prince Albert is a much more favorable locality than further south, as far as our experience with forestry goes to show; but I do not think that we can hope with our present list of apples to have any of them succeed in that climate. We have been sending out seed of the hardy varieties of Russian apples and grapes to settlers asking them to plant the seed and allow the tree to remain where the seed was planted. Perhaps we may get fruit in this way, and I have advised them to go on planting seed until we find something sufficiently hardy to stand the climate.

Mr. SHORT: What do you find the difficulty? Is it the Chinook winds?

Prof. CRAIG: The trees have not the ability to stand the cold.

Mr. SHORT: I have planted trees. They would do all right the first season, but in the next June or July they would die. They would leaf in the spring.

Prof. CRAIG: They had been root-killed.

Mr. RACE: This gentleman (Mr. Blake) says that he has had an orchard of Kings that he has made fruitful.

Mr. BLAKE: It is a very high locality, and they have been very average bearers every year. I have planted them mixed with Baldwins. I do not know whether that has produced an effect, because I have not planted them separately to see.

The SECRETARY: What are they grafted on?

Mr. BLAKE: On the natural fruit stock, mostly top-grafted.

Mr. RACE: And they bear every year?

Mr. BLAKE: Bear every year, and very fine, smooth apples, too.

Prof. CRAIG: Did they begin to bear young?

Mr. BLAKE: Yes; my oldest tree has been bearing for thirty years, and bears healthy fine apples now.

Mr. PEART, of Burlington: It seems to be established beyond dispute that there are some varieties of strawberries that are sterile, and at Orillia last year the Brighton and Lindley grape and Bartlett pear were stated to be sterile. Have there been any experiments to show that any variety of apples is absolutely sterile?

Prof. CRAIG: I have been carrying on some work for two years on that line. It is a very simple investigation. You simply have to cover the blossom of the apple with a paper sack to exclude all outside pollen. At the farm at Ottawa we have not yet in bearing a number of commercial varieties which I would like to report on, such as the Baldwin, the King, the Spy, and apples of that class. I have got results of a great many hardier kinds like Yellow Transparent and a number of Russians, but have not got results sufficiently definite to warrant me in giving them to the public yet. The experiments will be carried on and the results published as soon as possible.

Mr. BEADLE: Mr. Waite sent me a paper some two or three years ago in which he set forth some investigation he had made, and he had come to the conclusion that the Northern Spy was self-sterile; that if you plant a large block of Northern Spys together you would get no fruit. I remember at our convention at Hamilton Mr. Rice told us about an orchard that had been barren of fruit for twenty-eight years, and he was besieged with questions. I remember asking him if he had Northern Spys anywhere else than in that block. He said yes, he had a few in an orchard near his house mixed with other trees, and I asked the question if they bore there. He answered that they bore very well there. Then I made the remark that botanists knew very well that there were certain varieties of fruit that were self-sterile. I remember some shrubs that grew in my own grounds that were self-sterile, but when I got other shrubs of the same variety planted near they bore seed rapidly. Now, I do not know whether this Northern Spy is self-sterile or not, but possibly this may be a solution of Mr. Rice's trouble. I sent a copy of Mr. Waite's paper to the Secretary, who published it in the *Horticulturist*. I was in hopes that it would fall into Mr. Rice's hands, and perhaps set him to try the experiment of grafting some of his Northern Spys with some other variety and see if it would have any effect upon his orchard.

Mr. TURNER: I think the orchard referred to in Hamilton belonged to Mr. Fisher, of Burlington, and he is here to-day.

Mr. FISHER: I have nothing more to say about that orchard. It continues to disappoint me every year. I would like to ask Mr. Craig if in the course of his experiments he is prepared to recommend a variety for each group—a variety strong in pollen that would be suitable for fertilizing each group that he has made according to the time of blossoming.

Mr. CRAIG: Mr. Fisher's question opens up another avenue. He says, "A variety strong in pollen." That means a variety with pollen of more than ordinary vitality. I do not know that.

Mr. CASTON: Or abundance of it.

Prof. CRAIG: It is not always the abundance of it; it is the character of the pollen itself, and that can only be found out by testing the germinating power of pollen just as you test the germinating power of seed. I cannot tell you whether the pollen of one variety is more vital than that of another.

Mr. FISHER: It is the fertilizing power we are after.

Prof. CRAIG: Well, that lies in the vitality.

Mr. BOULTER: I have 400 Golden Russets in one block and I have never had a crop of apples on them yet, and they have been thoroughly cultivated. They are all Golden Russets with the exception of two or three Ben Davis that were bought from an American for Golden Russets. (Laughter.) Wherever those Ben Davis' are they are bearing, and a little radius around of the Golden Russets have had apples on. I have 200 more Golden Russets, and the first thousand trees I put out, that have a row of Northern Spys and Maiden's Blush put right through them, and there I had some Golden Russets this fall, and that is all I had. On the other side of the orchard there are 300 Northern Spys in a solid body. Mr. Caston has been recommending top grafting, and I think I will take chances on that and top graft some of those Golden Russets. It is possible that the Russets having no other variety among them may be the cause of their not producing as well as they should. I never thought of that till to-day.

Mr. HALL: I think if you got two or three bees in your orchard they would carry your fertilizing element, although I don't suppose you would then get any honey for your table.

Mr. CASTON: There are some seasons when the bees don't get a chance to work.

Mr. HALL: Then you don't get any fruit.

Mr. CASTON: No. I am never so well pleased as when I see the bees busy. Last spring we had an extraordinary spectacle, the trees being white with blossom and white with snow at the same time, and the bees had no chance to work. The next farm to mine had an orchard that did well because the bees worked there when they could not work in mine. I attributed the difference largely to that fact. I was asked if there was any apple that would fertilize the Spy. I think this one shown here is suitable. It is known in our district as the Red Pound; the Fruit Growers' Association named it the La Rue, and it is known in some sections as the Baxter. It originated down near Brockville, I think, on the St. Lawrence. I would recommend any one who is trying the experiment of grafting their Northern Spys to try the Baxter. It is a free grower.

Mr. SHERRINGTON, Walkerton: I am in favor of bees as a fertilizing power in orchards. In a village in our vicinity an old Scotchman who had a considerable plum orchard, said to a large bee-keeper one day when the weather was very still and damp and the bees were not flying, "Are your bees flying to-day?" The bee-keeper replied "No, it is too cold, damp, wet." "Well," said the Scotchman, "my plum trees are all out in bloom, and I can have no plums this year." Neither had he. Another man had another orchard of plums that were in full bloom a little time before or after this incident. The weather was fine and the bees were flying in the orchard thick. The man had fires all over the orchard smoking the bees away. He said, "You must take these

bees out or I will not have any plums;" but the bees did not care for the smoking and kept on with their work, and that man had a large crop of plums. If there had been winds to carry the pollen from one bloom to the other the Scotchman would have got plums, and so would the second man without the bees, probably; but the bees were the main means of bringing the crop of plums to that man's orchard.

Mr. BOULTER: Don't you think the smoke drove the curculio out of the plums?

Mr. SHERRINGTON: The curculio comes after the plum. I have a large orchard with Spys in a block, and I have noticed times that they did not bear; still I think they are not so far away but what they can be cross-fertilized with the other varieties, and I think it is very wise in planting to intersperse different varieties in the orchard.

You are all aware that there are varieties that will not self fertilize, and I think it is a very important point in planting to mix the varieties; but care should be taken that the soil is suitable for the different varieties. I have found on certain soils the Baldwin does well and on others it does not do anything. When the soil suits, the Baldwin is a good variety to plant with the Spys.

Mr. BOULTER: What is the best soil for Baldwins?

Mr. SHERRINGTON: In our localities the best is a light soil—a sandy loam. On the clays they don't do so well. I would certainly put bees in any orchard that has not got them. I would never think of trying to grow fruit without bees.

Prof. CRAIG: We should not go so far the other way as to think that all fruit tree blossoms are unable to fertilize themselves; in other words are self sterile. The majority are, and I was speaking of the exceptions. Most of the European plums are able to fertilize themselves, the blossoms being self-fertile, so that if they don't bear fruit it may be on account of some climatic influence—very great heat or sudden and prolonged heavy rains I think would wash away pollen so as to injure fertilization.

Mr. HALL: The professor has forgotten that he told us a few moments ago that it is important to have a foreigner to marry with this lassie bloom—that cross-fertilization is what was wanted to make a good offspring.

Prof. CRAIG: But you must remember that there are different sections of this subject. I was speaking of producing new varieties. I told Mr. Blake that the pollen of another variety had no influence on the fruit of this year, but if he wanted to produce a new variety he must cross it.

Mr. HALL: The strengthening quality of the apple, for instance?

Prof. CRAIG: That is what I say. Ordinarily it has no effect on the fruit of this year in changing its appearance other than helping development generally.

Mr. HALL: Does not it make it better in quality, larger in size, better in shape?

Prof. CRAIG: I don't think it will affect the quality or shape, but may improve the size.

Mr. SHERRINGTON: In one of our orchards a very close observer found growing on a Rhode Island Greening a perfect Golden Russet. All the difference was that just around the stem you would see the Greening, but the rest was a perfect russet. In the spring he cut the apple, but there was not a perfect seed in it. What was the cause?

Mr. BLAKE: I would like to ask, if the fertilizing fruit does not affect the present year's fruit, why do we plant strawberries of different sexes to fertilize the blossoms, to have the fruit of the present year?

Prof. CRAIG: To get fruit. In one case you don't get fruit, and in the other case you do get fruit. There are exceptions which nobody can explain. In all the animal kingdom we have what we call "sports." I had two specimens of apples sent into me this year each of which exhibited two varieties. One was a Golden Russet on one side as perfect as could be, and the other half was Ben Davis; and the line of demarcation was just as clear cut as if it had been painted by hand. I don't think this was the effect of cross-fertilization; it was probably a "sport."

The PRESIDENT: What was the flavor?

Prof. CRAIG: The flavor was Golden Russet throughout. It grew on a Golden Russet tree. I had another specimen of the same kind from Nova Scotia. These I only regard as "sports," and I don't know of any way of accounting for them.

Mr. SHERRINGTON: I have frequently met with raspberries where one-half would be red and the other half yellow. Is not that accounted for by the fertilizing of the fruit in its blossom?

Prof. CRAIG: I don't think so, because you can't get that constant effect every time. I have crossed hundreds of blossoms of strawberries and apples without that result.

Mr. WATKINS (Michigan): In my immediate vicinity there is a large tract of country about twenty miles long and two or three miles wide, called the Burr Oak Plains, very fertile farm land, and most excellent fruit land for about twenty years. All of a sudden that land, planted to orchards, began to dwindle, and after twenty-five years there has not been a bushel of apples taken out of the entire tract. We have such tracts all over the state. Every device that we could conceive of has been tried to produce fruit on this ground—frequently farm lands bearing heavy crops—a clay shale with a great deal of lime and plenty of potash, and supposed to be excellent fruit land. Now, if the pollenizing is perfect, what is the reason of all kinds of varieties failing on that land? Right by the side of that land there is a rise of broken land with a heavy clay loam bearing fruit perfectly to this day. You can almost throw a stone from one to the other along its whole line. It seems to me that sterilizes the whole matter of pollenization.

Mr. BEADLE: Do those orchards blossom well?

Mr. WATKINS: Perfectly, and perfectly thrifty trees, but no fruit.

Mr. BOULTER: And plenty of bees?

Mr. WATKINS: Yes, sir.

Mr. RICE (Michigan): I don't want you to learn any wrong lessons from my orchard, and if you can learn any good lessons from it, and get any good out of it, you will do better than I can. I will make you a little statement in regard to it. My orchard is situated in Wayne county, New York, the banner county for apples in the world. (Hear, hear.) If the evaporated fruit from that vicinity could be made up into apple pies they would reach continuously around the world. (Laughter.) My orchard stands on a hill, which is mostly heavy clay loam. As you stand on that hill in spring time and look along up the ridge road to the west and off towards the lake and see the orchards in bloom in every direction, you will see that you are in the midst of a garden of orchards, and they are all productive. I was always quite a theorist, and about thirty years ago people said that nurserymen were ruining their stock by continually cutting their grafts from nursery rows; and I said I will not ruin my orchards. I sent to Rochester for the trees. I said I cared nothing for the varieties, I was going to top-graft my trees from the very best stock to be obtained from the whole country; and I got good, nice stock, and I think that they stated that they were mostly Alexander apples, but there were some Northern Spies in the stock. After planting I had an expert go right through and top-graft. In cutting the scions I went to my father's orchard twenty rods away down on the ridge road—just down hill, as you might say—and I cut from Baldwin trees that were planted fifty years ago, trees bought from Maxwell Bros., of Geneva, and which, from the time they were large enough to bear, had never and have never really failed a crop. I cut, not from water-sprouts, not from lower limbs, but from the top limbs of the tree, so as to be sure to get the place where the wood was best developed and the buds best developed and in the best order. I did the same with my Greenings, and we went through and grafted. The stock took remarkably well, and the trees throve and grew, and I thought of the happy days I was going to have selling the fruit and living at ease. I waited for those days, and they didn't come. I went off to Michigan, where I had a piece of wild land, and I have been strug-

gling along there, occasionally going down to look at my orchard. I have not been there for four years. I don't care much about seeing it. One year the Greening trees bore $500 worth of fruit. I got half of it. The Baldwins have never borne a crop. The orchard extends in such a manner that the corners are on the south of the orchard, the furthest from the crown of the hill, and there are the longest rows in the orchard, the hill being narrower in the west end and wider in the east end. There are four rows of Greenings on the south of the line the entire length, and then come in the Baldwins. A few Golden Russets were planted about half way among the Baldwins. Two or three Red Astrachans were planted, and one or two earlier apples, and so on through—they were scattered through the orchard. Now, we have tried to get a crop of fruit, and we did not do it, and we can't tell why. The orchard blossoms, yet the trees don't produce. That orchard over the fence that I used to go and steal apples out of when I was a little boy is still there and bearing in a very nice way.

PEAR GROWING FOR PROFIT.

Mr. E. E. Beman, of Newcastle, read the following paper :

In preparing this paper, I have endeavored to give a few practical details, necessary to observe in making a successful business of pear growing, gained from experience in a fairly successful pursuit of pear growing for market for some twenty years, with an orchard of about two thousand trees. I will be as brief as possible, giving mainly practical pointers and leaving the theoretical part of the subject to others who may have more time to spend in that line.

The first thing to be taken into consideration is the soil and situation, for if that is not right, the whole business will only result in failure. I do not think there is much use to attempt growing pears any great distance from the ameliorating influence of the great bodies of waters with which our province is so abundantly supplied. The best soil I believe to be composed of a good, rich clay loam surface soil, with a deep alluvial clay subsoil. The pear being a deep-rooted tree, requires a soil in which the roots can extend downwards without obstruction, so as to obtain a plentiful supply of moisture, but the subsoil must not be springy, nor too retentive of water, unless it can be easily underdrained. The worst soil, in my opinion, is a cold, wet, quicksand subsoil.

In preparing the soil for planting, I would work it in about the same manner that I would if I intended to grow a first-class crop of grain by manuring, plowing, clearing from weeds and getting it in good condition for spring planting.

In planting an orchard for profit I would select standard trees. Dwarf trees may possibly succeed with a great deal of petting and pampering, but I have had no success with them in my own orchard. Select good, thrifty, but not too rapidly grown trees, not more than two years old. I would much rather have good one-year-old trees than three years old at the same price. As to what varieties to plant, this is a difficult question to answer. A variety that will succeed well in one locality may not do so a few miles away, or even on an adjoining farm if the soil is different. The surest way is to find out what varieties succeed in your own locality and on a similar soil. You also want to take into consideration the market you send your fruit to and what varieties sell at best prices. I would not advise planting too many varieties unless you are like myself, fond of experimenting and willing to lose money in doing so. Of course you can top-graft any that do not prove satisfactory when they come into bearing. As a rule I do not think the very early varieties are profitable. The principal varieties that I grow in my own orchard are the following : Bartlett and Clapp's Favorite. Duchesse Precoce ripens a few days later than Bartlett, resembles it in appearance, not quite so good for dessert, but very fine for canning, an exceedingly productive and profitable variety. Wilmot, a local seedling, not quite large enough, but very hardy, healthy, productive, of good quality when well grown and a good shipper, ripening from ten days to two weeks later than Bartlett, usually sells at fair prices. I also grow the following in smaller proportion : Anjou, Winter Nelis, Sheldon, Beurre Bose, Boussock, Goodale Howell, Mount Vernon and about one hundred and fifty other varieties, new and old, for the purpose of testing them.

There is one thing I want particularly to call your attention to and that is the distance apart to plant the trees. They are generally planted too close. I made that mistake in planting my own orchard, and now have to suffer the inconvenience of their being too close together to conveniently drive between the rows for the purpose of spraying and drawing out the fruit. Mark out the rows twenty-five feet apart, the rows running north and south if possible to allow each side to get the benefit of the sun. They can be planted a little closer in the rows, say about twenty feet. Prepare the trees by cutting off any broken roots and cutting back the last year's growth from one-half to three-fourths to balance the loss of the roots. Plant as early in the spring as the ground can be got in good condition, that is, when the earth is comparatively dry and friable.

Your orchard is now started, but do not think the work is quite finished, it has only commenced. On your careful attention to it now depends the pleasure and the profit to be derived from it in the future. Give it careful cultivation You can grow any kind of hoe crop to make it pay expenses, but do not grow any kind of grain crop, as by so doing you will seriously injure the trees. Put on sufficient manure to keep up a good healthy growth of wood. They will require special attention to trimming while young. The natural form of growth of the pear is the pyramidal, and it is best to train them in that form by giving careful annual attention in the latter part of winter and early spring, cutting back shoots that may have grown too strong, thinning out superfluous ones and occasionally pinching back some of the strongest in summer. You can get a well formed pyramidal top, with about three branches in each tier and each tier about eighteen inches to two feet apart, always watching that the lower branches have the advantage by keeping the top ones cut back or pinching back in summer. After the trees get well into bearing they will not require much trimming, only occasionally cutting out any interlacing branches and dead wood. I am now coming to a point in the management of a pear orchard in which many of you will disagree with me. We will suppose the trees have attained a good size, some commencing to bear freely. I would now seed down to clover and endeavor as much as possible to keep it into clover by annually sowing a few pounds of seed late in the winter, just as the snow is nearly all gone. Then when you have a very fine crop of grass don't get too greedy and try to take two crops from your land—a heavy crop of hay and a fine crop of pears. Be satisfied with the pear crop alone. Cut your clover about the same time it blossoms out and let it remain on the ground to rot and you will have a splendid mulch; keeping the sod comparatively open and the soil moist. The decayed clover will give you the nitrogen and humus necessary to keep the soil in good condition. Then before your pears are ripe cut the clover again and leave it also on the ground, never removing any of the hay, and you will have a nice clean orchard to work in with a good soft cushion for any pears that may be blown off. I cannot say that this method will answer equally as well in all soils, but I know from practical experience that it is a success in my own orchard. I have about two acres that has been seeded to grass about ten years, and it is the part of the orchard that has the best and largest trees, has had the least loss from blight and has produced the most and best fruit. One special reason I have for advocating growing in grass is the greatly diminished liability to blight, which is undoubtedly the greatest drawback to success in pear growing. In the part seeded to grass I have had very little loss from blight, while the cultivated part has suffered severely. I have it nearly all seeded down at present.

In regard to manures, I am inclined to think that the pear requires heavier manuring than the apple. I would use freely of stable manure, but not enough to produce too rank growth. As the ashes of both wood and fruit contain large quantities of potash and phosphates, I would apply plenty of unleached ashes if easily obtained; or if difficult to get, would use muriate of potash, to give the potash and bone dust to supply the phosphates. I will not in this paper say much about picking, packing and marketing. Pick most of pears before fully ripe, especially the earlier varieties. A very good way to tell when to pick is to gently raise the pear, and if it parts freely from the branch it is ready to pick. Handle carefully all through. Use the cleanest and neatest package you can get, whether barrels or baskets. Never use old dirty barrels to save a few cents. Pack under cover to keep all clean, and pack honestly, keeping out all wormy and poor fruit. You can

feed them to the hogs or sell them at home as culls. Then you will not be ashamed to put your name on your packages. Have them as good in the bottom of the barrel or basket as on top, and in time you will become known as an honest grower and packer, and you will get much better prices than you would by putting a few poor ones into the packages and spoiling the whole sample. In marketing, if you send to a commission merchant try to pick on an honest and reliable man, and send all your fruit to him rather than sending to several men in the same city. As a rule you will get better prices by so doing, as your name will become known to his customers and they will take your fruit in preference to other brands not known to them

Regarding the profits of pear culture, I think it pays as well and perhaps better than most branches of fruit culture in this province, providing all the conditions of soil and locality are right; but if they are not you will find the business very unsatisfactory. Not that I would discourage anyone from planting, but merely advising the same caution you would exercise in commencing any other business pursuit. If you know by other trees growing on your own land or in your immediate vicinity and on similar soil that they succeed, you will be safe to plant. Otherwise I would advise planting a few at first until you ascertain the adaptability of your soil to their growth.

The SECRETARY: I visited Mr. Beman's orchard this summer, and can vouch for the truth of what he has stated—the thrift of his trees and the excellence of his orchard—in every particular, and the excellence of the fruit that he grows under the methods that he has discussed. His orchard is beautifully situated on the north shore of Lake Ontario at Newcastle. His packages stand high in the Montreal market as those of an honest packer, and he is getting the benefit of that reputation. I think it would be interesting for us to know how he packs the fruit, the packages he uses and so on.

Mr. BEMAN: I have sent to Montreal market, which I find generally better than the Toronto market. I find that barrels pay better than baskets, taking into consideration the price of the barrels and the putting in the fruit. As a rule I put all my best pears in barrels. Possibly the Montreal market required a little different plan of packing, but I have been informed by the commission men there that they send a great deal of fruit out to other points, and they want it picked a little on the green side, and they rather have it in barrels. As for baskets, I packed quite a few, and they are sold in Montreal. This year I sent quite a few baskets to Toronto, and they did better than what I sent to Montreal. I always pack under cover; it keeps the fruit and the barrels and everything else cleaner. I very often in the barrels make two samples. Very often if I have very fine grown ones I will make two or three or four barrels of the very best that I have and mark them as "Extra choice selected," or something in that way. The second quality would of course be of first-class fruit, even in size, but not large. I think by keeping the large ones out and putting them in a separate barrel you would really get a better price for the mediums than if you put the extra large ones in. Then I have a third class occasionally with some varieties, and I send them to market and advise the commission men what the quality is and sell them on their market. I put in them nothing but sound, nice fruit in every respect, though not so large. If I can sell the culls at home, well and good; if not, I feed them out. Hogs will eat them, and it is better to do that than lose money by sending them away.

Mr. RACE: Do you pasture sheep or hogs on the orchard?

Mr. BEMAN: I never pasture sheep or hogs at all. My soil is very deep. The subsoil would be a good alluvial clay running down some places possibly eight or ten feet before you come to any stone at all, and of course there is any amount of moisture down there, and I don't find any difficulty from grass drying out; in fact I cut the grass down and it lies there, and at any time in the summer you may lift the grass up and find the ground all moist often in the driest seasons. The grass perhaps does abstract considerable moisture, but if the land is bare it will abstract it. I would be inclined to deal with apples in the same way as I have pears.

Mr. BEADLE: You have not been troubled with field mice?

Mr. BEMAN. No; I keep a good many cats, and they keep the mice down.

Mr. RICE: How do you protect the birds if you keep cats?

Mr. BEMAN: They have to stand the chances.

Mr. BOULTER: I understand you to say you put the trees about twenty or twenty-five feet apart.

Mr. BEMAN: I put mine sixteen feet apart, but if I were planting again I would not put them closer than twenty-five feet. In the oldest part of my orchards the trees have been planted twenty-one or twenty-two years, and the branches are so low now that I can scarcely drive through in spraying them.

Mr. BOULTER: As I am a large buyer of pears I was particularly pleased about that point in packing. I will hunt you up next summer.

Mr. FISHER (Burlington): Have you never had trouble from mice?

Mr. BEMAN: Not for ten or fifteen years.

Mr. FISHER: How long have you been pursuing this practice?

Mr. BEMAN: I have had one part seeded down now about ten years without having plowed up.

Mr. FISHER: The trees were large trees when you commenced this practice?

Mr. BEMAN: Yes.

Mr. FISHER: You would not dare to do this among small trees?

Mr. BEMAN: Oh, certainly not. I would keep it cultivated till the trees commenced to bear, or till the trees get a good size—for probably eight or nine years.

Mr. BOULTER: Don't you tread the first snow that comes in the fall around your trees?

Mr. BEMAN: No.

Mr. FISHER: That would be an awful task.

Mr. BEMAN: I have two thousand trees. You can tramp a great deal in a day, but I have never done it. One year I did lose quite a number of trees.

Mr. FISHER: The greatest disappointment that I have had in growing fruit trees was from field mice. I have endeavored to keep the orchards perfectly clean, but that doesn't keep the mice out. I find tracks of mice every spring all through my orchards that have been plowed and cleaned all through the season. They go through the orchards every winter in spite of the cultivating, and orchards that have been cultivated regularly are just the same as those that have not been cultivated. You say your experience with dwarf pears has not been satisfactory?

Mr. BEMAN: Not at all, I have not had any dwarfs now for about ten or fifteen years. I planted about forty trees altogether, a number of varieties, and they gradually disappeared and I have not one left.

Mr. FISHER: My experience with the Dwarf Duchess has been eminently successful. I have a large number of trees, and they have borne well and paid me well. The fruit sells well and it is of a pretty good quality.

Mr. BEMAN: In my locality the Duchess is not a success at all.

Mr. BOULTER: I noticed that Mr. Beman eliminated the Flemish Beauty entirely from his list.

Mr. BEMAN: I was so well pleased with the Flemish Beauty when I started that I planted 1,200 trees; but when they commenced to scab I top-grafted the whole lot except a few large ones. There is one point perhaps I should mention, and that is, for instance, the Bartlett, which is not a high growing tree. I have found as a rule it is rather strong and begins bearing very early. There is one variety I intend to plant ten

acres of—that is the Tyson, which is one of the hardiest growing trees. It is large and strong, and grows in pyramidal form. When they get large enough, in say two or three years' growth, having formed a nice top, then I would top-graft them to any other varieties that I think suitable. But the Tyson is not a success as a market pear, in some sections being rather small.

Prof. CRAIG: Would you top-graft on the main branches?

Mr. BEMAN: I would top-graft as far out as I possibly could. I don't top-graft any branches more than from a quarter of an inch to an inch stock. Of course this involves a great deal more labor in top-grafting, but I lose less time and have a better crop.

Prof. CRAIG: Have you tried the Keifer?

Mr. BEMAN: I have tried the Keifer. It grows well for a time and after that it becomes unhealthy. I planted three or four trees and lost all of them.

Mr. DEMPSEY: Does the Keifer grow large with you?

Mr. BEMAN: No.

Mr. MORDEN: The Keifer in Southern Ontario and Western Niagara would be a success on light soils, and will grow a fruit that not a half a dozen men in this room would stick up their nose at; but grown further north in Ontario or on soils more clayey, the quality I think would be rather doubtful, but at Niagara Falls we can get a magnificent crop of very nice fruit every year, and it only failed this year from that late frost.

Mr. BEMAN: I am trying a somewhat similar one, the Garber, a seedling from some of the Japanese varieties of pears, and I find it grows and succeeds a little better than the Keifer, but I think it is scarcely a good pear for canning. It has not been satisfactory to me, only it is a very fine grower, and it might make a very fine stock; I cannot tell yet.

Mr. MORDEN: Keep your Keifers on the trees as long as you can.

Mr. BEMAN: That is what I do I keep them on the same as I would any winter pear.

Mr. BOULTER: Have you found the Sheldon a good pear?

Mr. BEMAN: It is not a perfectly hardy pear, and with me it has blown off very badly; otherwise it was a fine market pear.

Mr. BOULTER: The Bartlett is rather delicate.

Mr. BEMAN: I think it is better to graft it on another variety. I have top-grafted 150 Flemish Beauties into Bartletts, and they are much larger than the trees that we originally planted as Bartletts; so I think that if I wanted to grow Bartletts I would do better by growing them on a hardy healthy stock off larger trees, and produce better fruit.

Mr. BOULTER: I put out 500 pear trees in 1879. In 1884 and 1885 I lost every Bartlett, every Sheldon, Osband's Summer, and Beurre d'Anjou; and all I had left was Clapp's Favorite and Flemish Beautys. The rest were winter killed. I am very anxious to grow Bartletts, as we use an immense quantity of them for canning, and we are now top-grafting all our Flemish Beautys with Bartletts. I have great hopes of the Sheldon pear.

Mr. ORR: I have planted pears on virgin soil that has never been cultivated, and that has been in sod since they were four years old. I cultivated them up to that date to give them growth, and I have them that have been cultivated regularly, and the blight has affected them equally; I see no difference whatever. I have never lost a tree of Sheldons; they are bearing splendidly, but as stated, they are apt to drop off. Every tree of my Clapp's Favorite is gone. I think the mouse question can be easily settled. We want one more association—the No-Fence Association. (Hear, hear). Twelve years ago in our section we determined to have no fences and we had a great fight with the

neighbors and with the municipal council, but we prevailed, and we took down our fences. The fences and the old ditches are the harbor for mice. We put tiles into the old draining ditches and closed them up. We had no fences between our neighbors, no fences on the road, and we have no mice.

A DELEGATE: Where do you live?

Mr. ORR: Fruitland, nine miles from Hamilton.

Mr. FISHER: I would like to ask Mr. Beman if in his experience in grafting large trees he has found the growth of top-grafted pear trees any more subject to blight than that of a tree that has grown up from the roots.

Mr. BEMAN: No, I have not; in fact I never noticed any difference.

Mr. FISHER: We had trees where the fruit was no good, and we top-grafted them, and for several years I raised Bartletts of superior quality on these grafts, but they have been blighted terribly; a top-grafted pear tree is more liable to blight.

Mr. BEMAN: In those two acres I spoke of there are about 150 in that block of Bartletts top-grafted on the Flemish Beautys, and I don't think I have lost more than one or two; in fact in the whole 300 I think I have only lost three or four trees.

Prof. CRAIG: Some three years ago I attempted to get some information with regard to the prevalence of blight in orchards cultivated in different ways, and to investigate the subject generally. I sent out a number of circulars to as many pear growers as I could find over the provinces of Ontario, Quebec and Nova Scotia, and asked a number of questions, and in duplicating the results I found about 65 per cent. of replies were in favor of growing pears in sod with a view to immunity from blight, and these replies were based on their experiences in that method of cultivation, and it was quite in line with what Mr. Beman said, though I think with Mr. Orr that you find exceptions, that it is impossible to account for. But I think in the majority of cases after pear trees come into bearing they are less liable to be affected with blight if grown in sod. Experiments have shown that the bacteria or germ which causes pear blight grows much more rapidly in a variety which has a superabundance of juice, and any variety when growing rapidly has much more juice in its tissues than when growing slowly. Arguing along that line, it is more reasonable to suppose that a variety growing rapidly would have more juice in its tissues and would be more likely to be blighted than otherwise. So I think Mr. Beman's method would be the right one in the majority of cases, and would hold true,

Mr. BEMAN: I have seeded down two acres, and was so well satisfied that I seeded the rest of the orchard last spring, but some of it had got a little dirty and I wanted to have it in a nice condition; in fact, I have been growing strawberries, which is not a very nice crop to get in good condition if you allow it to go too long. While on one part I sowed buckwheat, partly to get it into good condition—I thought buckwheat was good to sow in an orchard anyway—I summer-fallowed the other part. The part I summer-fallowed blighted very badly. The blight was very bad that year; blight seems to follow certain years. The part that was in buckwheat did not average nearly so bad. The next year I changed around again and the part that I seeded I sowed a few oats on, and the part that had been in buckwheat before, I summer-fallowed; and the part I summer-fallowed then was worse than the other, and the part that had a little grain in I suppose kept the soil cool and it was much freer from blight than the other. Judging from that, I would say that the soil should be protected in some way, either by growing grass or buckwheat, or by mulching.

Mr. BOULTER: Have you ever tried putting ashes around the trees?

Mr. BEMAN: Yes, and it is a great benefit.

The SECRETARY: Would Mr. Fisher tell us what packages he uses for the Duchess pear, and when he puts it on the market? We would like to know because the Duchess has not been very profitable of late.

Mr. FISHER: I got my best prices from a full barrel of hard green fruit. I make more grades than Mr. Beman does. I always take out a fancy grade, and I consider

this fancy grade of mine away beyond No. 1. (Hear, hear). There is no place in the barrel suitable for it. If it is left with the pile we of course would put it on the face, and it does not fairly represent the contents of the barrel, so we put it in a barrel by itself. Then I make about two grades—a No. 1, according to the sizes, and a No. 2—and always keep out the soft fruit and put it in a barrel by itself. This will make five or six grades of almost any kind of pears that I handle. As to the time: last winter I had a considerable quantity of Bartlett pears kept in Montreal in cold storage till about the 1st of April, and my commission men were so disappointed at the result that they paid the cold storage themselves. I think there is no time so good for selling pears as during the season of pears.

Mr. BOULTER: When a man wants to buy them.

Mr. FISHER: People are looking for them then. They are not looking for them in the spring or any other time out of their season. If we had some means of extending the season so that we could hold our fruit for a week or two till the glut was over, it would often sell at better prices than if sent forward when we now have to send it; but my experience with Montreal market this year was a little different from Mr. Beman's. I found Montreal market good for pears when mine were ripe. I got telegram after telegram from Montreal asking for pears, and those that I sent down there sold well at $10 a barrel.

Mr. SMITH: Did you get $10 a barrel for Duchess?

Mr. FISHER: No, sir. Bartletts.

The SECRETARY: What was the date?

Mr. FISHER: I don't remember the date; it would be perhaps the 10th of September.

The SECRETARY: You kept them as long as you could in the orchard?

Mr. FISHER: Yes.

Mr. MORDEN: Do you plant your dwarf trees deeply?

Mr. FISHER. I plant them very deeply, so that the union is at least a foot below the surface, and it may be that my trees root above the union and become standard. We have trees on the farm that have been standing for forty or fifty years. With me the dwarf tree is not a temporary tree.

The SECRETARY: I have been differing from both these gentlemen in shipping Bartlett pears. I always put the finest fruit in the smallest packages instead of the biggest. Extras I put in a basket; and I fancy I do better in that way than if I put them in barrels. With regard to extending the season of the Bartlett I have usually tried to do that, because at the height of the season they bring a very low price when the markets are full of them. So for two years past I have sent a lot of baskets of prime Bartletts, that were picked firm, to a cold storage warehouse, and paid to have them kept for two or three weeks until the glut of Bartlett pears was over. That just simply prolonged the market. By doing that I found I could get an advanced price over what I would have got had I sold them immediately. I think perhaps that is about the best way we can handle our Bartlett pears. I think Mr. Beman has the advantage over us all in that respect, as I understand he can leave his pears in his orchard unpicked, and save his cold storage altogether, until about the time when we would keep them in cold storage. His situation on the shore is such that for some reason or other I believe he is able to leave them unpicked until the season for selling.

Mr. FISHER: There is a gentleman living in Burlington who raises a considerable quantity of pears, who used boxes last year for shipping to Toronto. Each individual pear he wrapped in tissue paper by itself, and he realized about $12 a barrel for fruit shipped in that way. The size of the box was about four to the barrel.

The SECRETARY: But the secret of the high price was the time he put them on the market more than the package, probably.

Mr. FISHER: They were put on the market at the time of ripening; they had no cold storage.

Mr. HUGGARD: I have some sixty varieties of pears and some four or five hundred trees, and am interested in pear culture. I live near Mr. Beman, and have been watching his orchard. Our system is to grow corn the first year the young trees are set out—in other words, to cultivate the land thoroughly In twenty years I have only lost from blight some eight or ten Flemish Beautys and one Clapp out of eight I attribute this very largely to the extensive use of ashes. I have been asked twenty times a year how to get black knot out of cherries and plums. I replied at once, "By using plenty of ashes." I have never seen a tree where there was an abundance of ashes put round the roots that had black knot on it, that is if the ashes were put on before the tree was affected by black knot.

Mr. ORR: Is it the same with blight?

Mr. HUGGARD: My pear trees that were blighted and died got the same treatment as the other ones. In an orchard immediately below Oshawa, in a far more favorable locality than mine and equally as good land, I don't think the owner has three trees left in good condition out of 600. He didn't use ashes. I have a good word to say for the Keifer. I think I was the first man in South Ontario that had the Keifer growing. I brought it with me in a valise from Philadelphia from the Centennial, and have had them ever since. The trees never show the first sign of blight. They commenced to bear when they were three years, and some of them when they were two years planted, and they bear incessantly—(Hear, hear)—and if anyone will tell me how I can grow just half the number without spending time to take them off, I will be very grateful. On some of my trees this year I had thirteen props, on some nine, and so on. The quality of the pear depends largely on its cultivation and treatment afterwards. Situated as we are, immediately on the north shore of Lake Ontario, we often get an easterly wind and south-westerly wind that damages a large number of orchards over our section. It is largely the farmers' fault that they lose so much. The last twenty or twenty five years I have been preaching to the people to plant evergreens, but because they get them for nothing they won't set them out. In the county of Kent we find men that will buy five or six thousand evergreens to set around their orchards for protection, and they grow thirty or forty feet high. They have larger crops than we have in Oxford or Ontario county, because the wind is a very serious thing in our apple and pear orchards. We trim our young pear trees severely the first two or three years until they commence fruiting. We cultivate the ground and keep it very rich, so that when they are about six or eight years old they are in pretty full bearing. We set them out 16x20, and so far our trees don't seem to interfere, because they bear so much fruit annually that their limbs are simply like weeping trees. A pear like the Keifer with me overbears, while we have one or two other varieties that bear too many pears. We have quite a number of Clapp's Favorite that are large, beautiful, lofty, clean trees. I would not plant another Clapp's Favorite if you were to give it to me for nothing, because with me they will not bear. I have twenty or twenty-five Beurre d'Anjou, and they have not yielded me half a dollar a tree since they were planted quite a number of years ago. On the other hand one Keifer tree realized $11, and the Bartletts usually produce from five to eight dollars a tree where the fruit is allowed by the wind to remain till picking time. We make three grades of our fruit. If I am passing a tree any time through the summer and see a pear that is cracked or knotted I take it off the tree at once. If I see a twig or a branch that I think should be removed it comes off at the same time; and keeping an eye to business like this you soon get a neatly formed orchard without having to remove great large branches later on, which it is very injudicious to do. I find where you feed the trees and take care of them they will take care of you, without a doubt. I believe a large percentage of the blight to-day is produced by not thoroughly underdraining your soil. Mr. Beman said he would not set an orchard out in any soil if it had a swampy or leachy bottom; that is the worst kind for an orchard, but more especially for pears. I have a few Duchess trees which load every year with very fine specimens of fruit. We market our Keifers usually in barrels. I sent some thirty baskets to Montreal the other day, as they were requested instead of barrels for local use. Last year I sent them in barrels and realized a good profit. My

Keifers have paid me double any other kind of pear except the Bartletts. I think the chief trouble about pear growing in this country is that growers do not first make the land rich enough. They don't underdrain it enough, and they seed it down too soon after the young trees are planted. I don't purpose cutting out any wood till after the tree commences fruiting. I think I have a very handsome young orchard growing. With regard to cold storage, I just finished constructing one last week ; I have brought a specimen of some summer apples we have kept in it since the frost began until now.

Mr. RICE announced that the delegation from the Michigan Horticultural Society had brought copies of their annual report for 1894 for distribution, and would be glad to have the names of local societies to whom they might be sent.

PROFITS OF FRUIT GROWING.

The SECRETARY : There are one or two questions that might be taken up. One is " Should inexperienced men be advised to leave their business and engage in fruit growing for profit ? " You know that very often people interested in the sale of trees are inclined to rather exaggerate the profits of fruit growing. Now, I don't think that is the wish of this Society. We want to place before the public an honest view of this business. The other day I had a visit from a gentleman who is head master of a high school at a salary of $1,500 a year. He said he had been directed to me for advice, and wanted to know whether I thought it would be advisable for him to throw up his position and go into fruit growing. His age was about forty and he had two or three thousand dollars saved up and he was ready for hard work and thought he could do a good deal better and have a more comfortable home for his old age by going into fruit growing. I told him I would not advise him to do it and he was very much disappointed, and when he went away he thanked me for my advice, but nevertheless he said " I am inclined to go into it yet."

Mr. MORDEN : In my neighborhood of Niagara Falls I think I have seen more men fail at fruit culture after they go into it in that way than any other employment I can think of. I find our grocery keepers and our various tradesmen endure pretty well, but our fruit growers come and go, and the same is true somewhat of market gardening. There is a popular fallacy that there is a lot of money in fruit, that any man that cannot succeed in anything else can succeed in fruit growing. There is nobody knows more about farming than the man that lives in the centre of a very large city (laughter), and it is so in regard to fruit growing. I think our friends in the Grimsby district would agree in saying that there are a lot of people who rush into it and rush out of it again.

Prof. CRAIG : I would like to hear Mr. McNeill's views.

Mr. MCNEILL : I am in the position of the high school master who gave up a very good situation to go into fruit growing (laughter). I can say here that I do not regret it —(Hear, hear)—although I have been in the high school at least one month of the twelve ever since I left it, and like to get back, for no one enjoys teaching better than I do, and I had a first-rate laboratory just as I wanted it for teaching natural science ; yet, candidly, I am very glad I gave it up. I am much better physically, and I believe mentally. School teaching is usually regarded as an intellectual occupation. In most cases a man's intellect can't get to a funeral quicker than by taking up a class. He has to get out from his associations and strike out on independent lines before he can maintain his intellectual life ; that is my experience. The man who will devote himself exclusively to a school is on a fair way to intellectual decay. I would like to qualify that a little if I had time, but I cannot take time to do it. In addition to that I like to work, and I would rather to-day go out and work in a vineyard or a corn field than to be cooped up in any schoolroom that I know of for a whole day, and taking the whole work all the way through it is pleasant, and if any man cannot enjoy being out in the sunlight and air there is something wrong with him. (Hear, hear.) But as a money making institution fruit growing has not altogether been a success. For one or two years we made money rapidly—there

happened to be good times—but during the last two years we have had to learn some severe lessons of economy to make both ends meet, and I would not recommend it. I would say it is almost impossible for any high school teacher at the age of forty to make fruit growing a success. His physical powers are so run down that he cannot make a success of the work. At forty it is difficult for a man to get his body into position for the work—it is a dangerous experiment. If he has always been used to violent exercise it may not hurt him, but if he has always been in a school the chances are that the wrench to his physical system will be more than he can stand and his pocket will be decidedly worse. I have no hesitation in saying that ninety-nine people out of a hundred that go into fruit growing without a preliminary training on a farm from youth, or some other training in a preliminary way, will fail. I will put this as a rider. I got into it partly from the love of it and partly because I dabbled in real estate. I found a property that I thought was going to rise in value, and I thought I would not only get the increase in value, but make a profit out of it. I made it in that way, but I lost it in the actual practice of fruit growing. Notwithstanding that for a number of years I have been experimenting upon a large tract of land, yet when I got into the actual practice of fruit growing I found I had to begin almost at the bottom and learn the details all the way up. There is just as much in fruit growing as in anything else. A lady of my acquaintance, noticing the rough condition of my hands, asked me if I did not think I was wasting my life up there on the farm, at the same time complimenting me on my ability. I said "I find there is just as much opportunity for the exercise of every bit of ability that is in me as I did in the Windsor High School—(Hear, hear)—and if there is a bit of brains that is not thoroughly and systematically exercised on that farm, I would like you to find it out." (Hear, hear.) I don't feel it in any sense derogatory to me or anybody else to go into the matter of fruit growing. I feel just as much dignity when I am drawing a load of manure to the back end of the farm as I ever did when I was before a class. At the same time there is no money in it. A man is not sure every year of making a little beyond his expenses until he serves as an apprentice. If he has served his apprenticeship on a farm and is a man of considerable brains he can make money by it. I have served my apprenticeship now, and I believe I can make money out of it. There is money in it, but not for the amateur. It is a trade, it is a profession, just as much as any other profession, and has to be learned in the same way. As a novice would fail if he went into the watch-making, so if he goes into the fruit growing business he will fail. (Hear, hear, and applause).

Mr. A. H. Pettit: I would just like to give the audience a living example in this matter of fruit growing. Here is a gentleman who has taught a high school for a number of years, and he is here to-day as a practical fruit grower with all the energy any man might wish; you can see that from his remarks. I visited his place and saw that everything on his farm looks prosperous and successful, so I think he stands as a successful example of a fruit grower, coming to the place where my friend Mr. Woolverton advised the other high school teacher not to go. In regard to Mr. Morden's remarks, you can't point me a man in the Niagara district that has left the profession of fruit growing and gone back to farming or any other business. If there is any one profession above another where a man can live an enjoyable life, a profitable one, a successful one, and one that he can leave and hand down to his children, it is fruit growing. That can be followed out to advantage by the man who mixes a considerable amount of brains with his work. (Hear, hear, and applause).

TOP GRAFTING ON TOLMAN SWEET.

Mr. President: Mr. Caston has a subject which he will introduce now.

Mr. Caston: I think the question of top grafting on hardy varieties is one of the most important for fruit growers in this country. The King stands at the head of all apples to-day, as you will find from circulars sent from the Old Country; and yet the trouble is that it is not a good bearer. There is more money in that apple if you could

get it to bear well than any other apple in Canada. Last year and the year before the Newton Pippin brought a higher price in United States, selling at thirty shillings a barrel, but the popular taste in the Old Country is more favorable to a colored apple. This year we find the King sells away ahead of the Newton Pippin, having been sold as high as twenty-three shillings a barrel lately, while the Newton Pippin has not brought more than eighteen or twenty. In the fall of '94 I found an orchard about five or six miles from my home on the side of a hill where an American had been around a few years before and put in a seedling, and a graft had been put in on each side of the King, and it was literally bent down in the shape of a cone loaded with the finest specimens of King apples I ever saw. It was facing the south and these grafts were growing on the old seedling. I always advocate grafting these tender varieties on a hardy stock, for you will find that it is the stock of a tree which first gives out. Sometimes we have found them to be killed by the frost, sometimes bursting of the bark, and in 1884-5 we had them killed in the crotches—I lost sixty in that way. Such varieties as the Tolman Sweet and the Duchess would stand any year in almost any climate, and when we top-graft them in the branches we get above the point of most danger. It stands to reason that that hardy trunk is more able to carry up the nutriment to those tender varieties than its own trunk would be. [Mr. Caston here exhibited specimens of the King and Duchess of Oldenberg of about the same age and taken from about the same position in the orchard.] The wood of the Tolman Sweet resembles that of the Duchess very much. I claim we should have that kind of wood to resist the coldness in the winter. When Mr. Blake said he succeeded in growing the King by grafting it on a seedling he struck a most important point. We cannot grow the King in our county successfully at all by growing the tree on its own roots. It is too tender. They will grow till they begin to bear, and then they will do the same as the Greening, the Baldwin and the Northern Spy; but you can grow them by top-grafting them on a native seedling or on a Tolman Sweet. I prefer the Tolman Sweet because you are absolutely sure you have a hardy stock to graft on. I think the Tolman Sweet is a longer lived tree, and it does not require so much training, and it forms a very nice top for grafting on. This grafting requires to be done while the tree is young; it is not a bit of use grafting on an old tree while the wood has become dark. Make about three graftings of it, and it takes but a very few to form a top. After my experience of twenty years along this line I think this question of grafting the best varieties of fruit is one of the most important in this Province of Ontario. It is perhaps not important to the Niagara peninsula or the southern counties, but it is to the northern counties. I think it would apply to pears as well as apples.

Mr. Blake: My experience in grafting Kings on the bearing trees has been most successful. They bear more heavily grafted on the bearing trees, while the trees that are grafted on to Kings while they are quite young are not as fruitful as those that have been grafted in late years on older trees. I have noticed that in grafting them on Golden Russets the Kings are more prolific bearers than when grafted on any other variety.

The King in this last twenty years will outsell any apple in this market. I could fetch Kings in this market and sell every bag; there would not be another apple sold till those Kings were sold.

Mr. Rice (Michigan): This matter was brought up in our Society, and Mr. Morrill, of Benton Harbor, made a statement that in his orchard he had a number of varieties of trees. Among others were the Tolman Sweets and he re-grafted his Tolman Sweets to some other variety growing alongside of it. As they came into bearing his re-grafted Tolman Sweets yielded him from year to year about an average of four bushels of fine apples more than the same variety in the rows adjoining. Now, if that is true it shows a great and very important difference in the amount of money you are going to take from your orchard; and I have taken pains to ask the people about the country if they have known of any instance where Tolman Sweets have been grafted to any other apples, and what the results were, and invariably they were heavy producers of fine fruit.

Mr. SHERRINGTON: I think there have been some good suggestions thrown out here for your experimental stations to take up; for instance this top-grafting on to different varieties of stocks. With us the King is not a good bearer at all. The trees seem hardy and thrifty growers, but they do not bear the fruit. In other locations not far away it is said that they bear very well. Now possibly there is something in the soil to cause this King to bear.

Mr. RACE: I did not know there was any difficulty about the hardiness of the King.

Mr. CASTON; Oh, yes.

Mr. BLAKE: There is a distinct variation between that apple and the one shown on the table.

Prof. CRAIG: One is from British Columbia and the other is from Ontario.

The Convention adjourned at 5.45 till 7.30 p.m.

FIRST DAY—EVENING SESSION.

This session was held in the Town Hall, Hon. John Dryden presiding.

Hon. Mr. DRYDEN said: I am very glad to meet you, gentlemen. I have come because I want the Fruit Growers' Association to realize that I am just one of themselves, and consequently I want the outside public to understand and know definitely that I am in hearty sympathy with the work you are engaged in, and that anything I can do at any time to further the work of the fruit growers or assist the work the Association is doing, I will be only too glad to do it. This Association is one of the oldest in connection with agriculture in this province. I remember the work it was doing in my younger days. When I was a young man I was a member of the Association, and I have now on the farm trees growing which came through this Association. I believe in those old days a good deal of the work of the Association was lost somewhat—that is to say, no real record was kept of it, and although good did result, not as much resulted as if a good record had been taken of what was done. No real record was taken of the results of sending out new fruits. At the present time the Government is not suffering any information of this kind to go to waste, but gathering it up for the benefit of the public. (Applause.)

Mr. J. S. COLE, Mayor of Woodstock, said: It affords me great pleasure to be here with you, and in my official capacity to welcome you. In doing so I am sure I voice the sentiments, not only of Woodstock, but of the surrounding districts, and I think the delegates last year deserve a great deal of praise for drawing the Convention to this town. It advertises our town to a great extent and brings strangers here. We are proud of our town, and consider it one of the best in the province. We are all interested in it, both young and old, male and female, and interested in the development of one of the industries that I look upon as almost in its infancy. I think the people are just waking up to the fact that there can be markets opened up for the productions of this country. (Applause.) While I am glad to see a number of men from our rural districts taking an interest in this industry, I regret that at this season of the year our town is not looking its very best. It has got on its winter mantle, and is not so attractive as it would be in June. I think in no town in this province are there people that take more pride in keeping trim and neat their premises and boulevards than in Woodstock. Our town is noted for its maple trees. I offer to you the freedom of the town, and extend to you a very hearty welcome. (Applause.)

ADDRESS OF WELCOME.

Mr. T. H. Parker, President of the Local Society, read the following address of welcome :

Mr. Chairman and Gentlemen of the Fruit Growers' Association :

On behalf of the Woodstock Horticultural Society I beg to thank you for the honor you have done them in holding your annual meeting here under its auspices. The information that we may get from so many trained and experienced fruit growers and horticulturists will no doubt be very valuable to our members, as well as to the province generally. Your Association is doing a good work in developing the fruit growing capabilities of our country. No government can spend a reasonable amount o money to better advantage than in assisting such institutions as yours.

Our society has not been in existence more than nine months, yet we have about ninety members. We have not done much as yet, but hope that these meetings will stir us up to greater efforts. The annual meeting of your Association took place here about twelve years ago. I believe it was a most satisfactory meeting to all concerned. Trusting that this meeting may be equally so, I again thank you for your presence here.

Hon. Mr. Dryden : On behalf of the Fruit Growers' Association, I am asked to offer a few words in reply to what has been said by these gentlemen. I am sure the fruit growers appreciate the words of welcome that have been given, and the truthfulness of the remark about this being one of the best towns in the province. The difficulty with me is, I have just left another town where we had a meeting last night, which, they say, is best described as the Royal City, and they claim that is the best spot. It seems wherever you go there is a certain amount of pride which the local people have in their own town or city. I am very glad that is so. Often, in visiting various towns in company with the Lieutenant-Governor, I have seen over the archway the words, "Welcome to the Garden of Ontario." It seems every town and every city is the best, and every township and every county is the garden, and the only thing a stranger can conclude is that all the towns are beautiful and that all the country is a garden spot. (Hear, hear.) My friend, in giving us welcome, spoke about the information they will be likely to receive from these meetings. I am very glad he suggested that thought. That is just exactly one of the things that it is expected will be given to the public by an association of this kind. Since I have had the honor of occupying the position which I do in the Government of this province I have been endeavoring to use the information which you, gentlemen, bring to these meetings by extending it to the people generally, that a connection be made between the farmers of the country and my Department, and I have offered to give them all the information which you receive here in a report which will be published later on. I conceive in that way that I am fulfilling one of the legitimate functions of my existence as head of the Department, by conveying information to the people so that they will be enabled to do better for themselves than they have ever done before. I believe in the education of everybody, and this is one kind of education which I refer to. I believe that those who are to undertake fruit growing ought to know something about it; and I don't know any other means of disseminating information except to use the experience of the oldest fruit growers, and to have it put in such shape that those who cannot attend these meetings may read it in their own homes. Then my friend suggested that all classes of the community are interested in the work of this and other agricultural societies ; that is another good thought which ought to be emphasized here. We have had such experience as compels us to the view that this country depends perhaps more than we have thought on the success of agriculture. All classes depend upon it. Depression in agriculture touches the agricultural pocket first, but it is now touching the pockets of the people who live in the villages, towns and cities, and whether they are willing to admit it or not, they are forced to the conclusion and conviction that it is nothing but the truth that if our agriculturists do not prosper neither can they. Therefore all classes of people should give a helping hand to carry forward this good work. We are glad to know that the fruit growers are to have

the freedom of this town. I would suggest that the Mayor did not mean that you are to go away without paying your hotel-bills.—(laughter)—What he means is that you are to have perfect liberty to walk up and down these beautiful streets without fear of being molested by anybody—(laughter)—He means that you are to have the use of your eyes here, and take whatever you can that will benefit you that you are permitted to see in the city. I trust that you will use the freedom he has just given, and that you will go away feeling that this is a good town in which to hold conventions, and that you may have some disposition to come back on another occasion. I am sure that every member of the Association will be pleased with their visit here, and I trust the meetings will be of such a character as that not only the people in Woodstock will receive information but that the members of the Fruit Growers' Association themselves will receive valuable information to aid them in their important work. (Applause.)

PRIVATE CONSERVATORIES.

Mr. D. W. KARN read the following paper:

I have had the above subject assigned to me for a short paper. In opening this question for discussion to-night I feel myself utterly incompetent to deal with the subject, having no knowledge or experience apart from the little I have obtained in connection with my own home life. Therefore I shall only speak of it from the standpoint of growing and producing flowers, shrubs and foliage plants for private use.

Most modern houses to-day, especially in our towns and cities, are lighted by gas, and when this is the case it is almost impossible to succeed in the cultivation of flowers, as the gas is a deadly element to all plant life. The only means to overcome this difficulty is to erect conservatories or greenhouses adjoining the house, but so separated as to exclude all the blighting effects of gas. In designing a conservatory, light, heat, air and water have to be considered. The simplest form of constructing a conservatory is a lean-to, so built as to face the south if possible. This can be made ornamental if so desired by means of architectural embellishments.

Heating is a very important item. The best and most approved method is hot water. There are numerous styles of hot water boilers, but they are all built upon the same principle, each inventor striving to expose the greatest possible heating surface to the action of the fire. It is preferable to heat the conservatory independently of the house, as during very severe weather it is necessary to force the fire in order to maintain a proper degree of heat, which in many instances would give too much heat in the house.

Ventilation is accomplished in various ways. In small houses by lifting or sliding the sashes placed in the roof for that purpose. Shading is required as spring approaches, when the rays of the sun increase in power and light. This can be accomplished by washing the glass with lime-wash or with whiting and milk, but if you prefer you can use a screen of muslin or thin cotton.

A conservatory covering some 550 feet of surface measurement and about 5,000 cubic feet of air space can be sufficiently heated in all kinds of weather with a hot water boiler costing from $50 to $75 and will consume from five to six tons of coal a season, so that with an outlay of $250 or $300 apart from the running expenses any one may have a conservatory, together with all the enjoyment and pleasure of being surrounded during the dreary months of winter with beautiful flowers and green foliage. To love and cultivate flowers is one of the few pleasures that improve alike the mind and heart and make every true lover of these beautiful creations of infinite love, wiser, purer and nobler. It is a pleasure that brings no pain, a sweet without a snare. If we would develop and increase the appreciation of the beautiful and our ability to enjoy the marvellous beauty which is everywhere around us we must have the educating and refining influence of plants and flowers in the home. Our homes must be made attractive so that lasting influence for good may be thrown around those entrusted to our care. The

Creator doubtless could have made a world without a flower, but He in His wisdom did not do so, and after creating man in His own image He placed him in a beautiful garden in which was every plant that was pleasant to the sight or good for food. When man became a law breaker he was expelled from this garden and had to work for food among the thorns and thistles. In all parts of the civilized world to day the refinement, innocence and happiness of the people may be measured by the flowers they cultivate.

The conservatory places within our reach at all times plants and flowers for the decoration of our parlors and dining rooms. There is nothing to my mind that lends so much charm and beauty to any home as a tasteful disposition of plants and flowers. The amount of genuine satisfaction, rest and pleasure that a business man receives and enjoys in spending a few minutes in the conservatory each and every day more than repays him for the additional expense incurred in maintaining the same. I am convinced that many who could afford the expense of a conservatory if they would only try the experiment would be loud in their praises of the pleasure and satisfaction derived therefrom.

The necessary materials used in building a conservatory can be purchased already manufactured to shape, so that any ordinary carpenter can easily construct and complete the work. The putting in position of the hot water pipes is only the work of a few hours by some competent steam or pipe fitter. With the conservatory thus completed you are in a position to cultivate successfully plants and flowers, native and otherwise.

THE ONTARIO AGRICULTURAL COLLEGE AND HORTICULTURE.

Dr. Mills said: Not being a horticulturist, I have but little to say to you this evening, therefore I asked the chairman to be so kind as to allow me to speak what little I have to say before my friend Dr. Saunders, who has had so long and so varied an experience as a horticulturist, that he might have the remainder of the time at the disposal of the meeting. I desire first of all to congratulate you most sincerely on the work which you have done and are doing from year to year in this province in sending out new varieties of plants and fruit trees to be tested by the members of the Association in different localities: secondly, in preparing lists of apples and grapes adapted to the different climatic conditions which we find in this province. I think that a very valuable work, and I hope you may extend it to cover plums, raspberries, pears and some other fruits. Thirdly, I congratulate you on the dissemination of much valuable information through the publication of the *Canadian Horticulturist*, which has done and is doing such valuable work. Fourthly, I congratulate you on the publication of so valuable papers, addresses and discussions in your annual report—so valuable as to amply justify the Minister of Agriculture in spending the public money in distributing it to the people and farmers of the province at large. Fifthly, I congratulate you on the help you are giving to the Minister of Agriculture in carrying on the work of our provincial fruit and experiment stations. That help already given has been valuable, and we expect to have it continued. Sixthly, I congratulate you on the very valuable assistance which you gave the Government in making so excellent an exhibit of fruit at the Centennial Exhibition in Philadelphia and at the great World's Fair in Chicago. (The chairman: Hear, hear.) I have often asked myself whether it was really possible that at that great Fair, with such extraordinary competition as there was there in fruit, that this Province of Ontario should actually receive about thirty-five per cent. more marks or points for its fruit exhibit than any state in the United States. Think of it. Thirty or thirty-five per cent. ahead of California, of Florida, and of the great State of New York, of Oregon, and of every other state in that great country. It seems to me a very great achievement, and that grea credit is due in the first place to the ability, industry and enterprise of our people at large; in the second place, to the assistance given by the Government to make tha exhibit; in the third place, to the help of this Association from its directors and member all over this province; and fourthly, and largely to our friend Mr. A. H. Pettit, one of

the esteemed members of your Association. (Applause.) Now, I have often thought of that achievement. I don't know why it has rested on my mind so much, but it actually has, because it seems to me so extraordinary indeed; and as often as I did so I have said to myself that of the many wise and good things which the Hon John Dryden has done since he became Minister of Agriculture, he never did a wiser or more magnanimous thing than when he selected a strong pronounced political opponent, Mr. A. H. Pettit, to prepare our fruit exhibit and to take charge of it at the World's Fair at Chicago. (Applause.) I say it is a blessing to a country when men in high places do the best thing for the country regardless, to some extent at least, of party claims and party demands. (Hear, hear and applause.) Now I want to say that in my own judgment Mr. Pettit did his work there about as well as it was possible for any man to do it; and had a less able, less shrewd and less energetic man charge of the work of preparing that exhibit and looking after it in Chicago, the results would I know have been very different, because he had very able and very shrewd men to compete with at that great World's Fair. Now, I came here merely to bring greetings from the Agricultural College at Guelph, from the staff of that institution, and tell you we are interested in your work and wish you abundant success in every department of it. We are doing something in horticulture at Guelph, but in judging us I wish you always to bear in mind two things: First, that our climatic conditions at Guelph are very unfavorable—I believe even more unfavorable than at Ottawa, as some of you know—and in the second place that we cannot, like our friends at Ottawa, devote the whole of our time to experimental work. At Guelph our chief work is to instruct the young men who come to us from year to year, and our horticulturist, like other members of the staff, has to give altogether the greater portion of his time to education rather than to experimental work. We are doing something along the line of horticulture at Guelph. We have a course of lectures on fruit growing concerning the varieties grown in this province, methods of preparation, planting, cultivation and all the rest of it; second, on vegetable growing; we have a large vegetable garden for practical instruction and a full course of lectures on the growing of vegetable; third, on floral culture to some extent; and in the fourth place to a limited extent landscape gardening. That is the outline of our course of instruction in the department of agriculture. In addition to that we have, I think, a pretty thorough course of practical work in the outside department. In grafting we have practice throughout the winter; we have a building and all appliances adapted to that work until students become somewhat proficient in the work of grafting. We have pruning work in season on apples, raspberries, vines and other plants. We do something at hand-pollenization, and endeavor to give a practical course in testing and planting seeds, the preparation of plants by cuttings, by budding and transplanting, the preparation of soil for greenhouse plants, and in the preparation and application of spraying mixtures. As to the equipment for work in horticulture, we had very little until the present Minister took charge of the Department of Agriculture. I think now we can claim to be as well equipped in these lines as most institutions on the continent. We have a nice young orchard—I am sorry to say it is a young orchard, because a good many mistakes were made years ago in planting out orchards there in the wrong place, and they had to be rooted up. We have a fair-sized vineyard, a small-sized fruit plantation presenting a fair variety; we have eight acres in forest-tree plantation; a good arboretum on the College lawn arranged originally by our friends Messrs. Saunders, Beadle, Beall, Dempsey and some others. It has since grown to be a very fine one, and of great service to us in instruction. Then we have a large group of flower beds in front of the College throughout the summer and autumn, and we have a garden of about six acres devoted every year to the growing of vegetables for practical purposes, and also for purposes of instruction. We have six good greenhouses, I think up to the requirements of the present time—one large house for forcing vegetables for winter and early spring growing lettuce, radishes, cauliflowers, rhubarb, cucumbers and tomatoes all through the winter and until such vegetables can be obtained from the outside in early summer. Then we have a good propagating house with a very good propagating oven in it, and an intermediate house, a tropical house, a conservatory, and perhaps what is more important, we have a house that is adapted more es-

pecially for laboratory work of students in hybridizing, seed-testing and other things of that kind, and close by we have a large and commodious class-room so arranged that the plants can be taken in there all the winter through to illustrate lectures on horticulture and botany; and in conjunction with that class-room we have also a room for microscopy, furnished with microscopes and all other appliances necessary for the study of plant physiology and plant etiology, including all the injurious fungi that fruit growers are struggling against at this present time. So that you see in our course of instruction and our practical work we have a fair outline for doing something that ought to be of value to the students who come to us, and also to the province at large. We have not had this equipment long, and have only got nicely to work, but we hope in the near future to be able to do something that will be of benefit to you and to us and to the country in which we live. Now I wish to refer to one or two items of our experimental work. I wish to tell you that the black walnut is growing very nicely with us, to our surprise, notwithstanding the inclement climate of Guelph. We have a nice clump that was planted in 1880. The growth is slow, but the trees are growing healthy. The average diameter is between five and six inches, some of them reach between seven and eight inches in diameter. This is something we scarcely expected in the neighborhood of Guelph. Last year our horticulturist, Mr. Hutt, planted 123 varieties of strawberries in a plot near the College, and if he can protect them from the students and citizens and visitors we have through the summer we hope he may be able to report something in regard to that work not many months hence. We have only begun experimental work, and the time is chiefly taken up with teaching, but we hope to do something more in that line. (Applause).

The CHAIRMAN: Mr. Mills has referred to my magnanimity in appointing my friend Mr. Pettit, but he does not know I have had to suffer for it. Not long ago I was engaged with a member of the Conservative party, and this was one of the attacks he made upon me, that we had spent too much money in connection with the World's Fair. He read two or three items, and two names were mentioned. One of these was my friend Richard Gibson, of Delaware, and the other my friend Mr. A. H. Pettit. When I took occasion to tell my good man that these two men, whose names he had read out, were members of his own party, he blushed all over his face and wished he had not said anything about it. (Laughter.) But I said these men belonged to a different type of Conservative to what he happened to belong to. Mr. Gibson and Mr. Pettit are both loyal to the best interests of their province, whereas this man wanted to find fault with us because we were holding up our province to the gaze of the world and advertising our products everywhere. (Applause.)

THE PROGRESS OF HORTICULTURAL WORK AT THE DOMINION EXPERIMENTAL FARMS.

Prof. SAUNDERS, in introducing his paper said: While sitting here, I could not help recalling the scene of twelve years ago, when I had the pleasure of being present in this same room at the annual meeting of this Association. I was thinking what a world of change has taken place during those twelve years—the great volume of information that has been given to the public on the subject of fruit growing, and the wonderful advancement that has taken place over the whole of the Dominion in the cultivation of these most valuable articles of diet; the twelve volumes of the *Horticulturist* that have been published since then, replete with information in every direction; the twelve annual reports of the Fruit Growers' Association which have been distributed among thousands of farmers, carrying to them all the information they need in regard to the cultivation of varieties; the enlightened measures which have been adopted by the Province of Ontario; of this preparation of which we have heard so admirably from Dr. Mills for the instruction of young men at Guelph, which has all been established since we last had the pleasure of meeting at Woodstock—not the instruction itself but its horticultural department—largely through the earnest efforts of Dr. Mills, aided by the kind help of the good Minister of

Agriculture at his back ; and the young men of the present day have all these advantages which we old fellows of the past have never had the privilege of using. However, we have done our best. I miss some faces to-night that were here twelve years ago. Some have gone to their long rest—some noble men who have done good work. I am thankful, however, that a good many of the old faces remain to grace the present meeting, and I hope that those who are here of the old stock, as well as many of the new, will be spared for many years to continue the good work they have been doing. The study of horticulture embraces both the science and art of the cultivation of fruit, garden, plants and ornamental trees, both for educational purposes and for use. The art of gardening is a very ancient and honorable one, and is very congenial to man's nature ; it exerts a refining and elevating influence which no other occupation can give.

The study of horticulture embraces both the science and the art of the cultivation of garden plants, fruits and ornamental trees both for decorative purposes and for use. The art of gardening is an ancient and an honorable one and very congenial to man's nature over which it exercises a refining influence. The careful student of the sacred word will observe that in the earliest mention we have of a garden, in Genesis 2, that the beautiful and ornamental is placed before the useful. In the 9th verse of that chapter we read, "and out of the ground made the Lord God to grow every tree that is pleasant to the sight and good for food." Thus provision was made that the sense of beauty which the eye detects and which captivates and refines the mind, should be fed at least equally with the grosser sense of bodily appetite the outcome of our physical needs. In a new country, however, like ours, where at first the struggle for subsistence is keen and the subjugation of nature to man's needs a primary consideration, the regard for the useful naturally takes precedence. It is needful for man's existence that he be fed, and in the steady improvement which has taken place in the condition of our people we want our diet now to include choice viands. Thus fruit growing has become a very important branch of industry, the magnitude of which is only understood by those who have looked into the subject carefully, and the possibilities of fruit growing in this great Dominion cannot yet be estimated. In the Act of Parliament by which the experimental farms were established, among other objects of research prescribed, was that of testing the merits, hardiness and adaptability of new and untried varieties of fruits, vegetable plants and trees, also to conduct experiments in the planting of trees for timber or shelter. Thus the whole domain of horticulture was included. During my remarks on this occasion I hope to be able to show you that this important division of the work has not been neglected at any of the experimental farms. In order to present this subject to you clearly it will be necessary that I treat of each farm separately since they are located in widely different climates, in each of which there are difficulties to encounter.

Perhaps it would be well that I should give you at the outset a very brief sketch of the system of Dominion experimental farms and indicate to you the districts which these several farms are intended to serve.

The experimental farms of the Dominion of Canada are five in number and contain in all more than 3,000 acres of land. They consist of a central farm near the Capital, Ottawa, and four branch farms. The central farm has been established near the boundary line between Ontario and Quebec, and serves the purposes of both these important provinces. One of the branch farms has been located at Nappan, Nova Scotia, near the dividing line between Nova Scotia and New Brunswick, and serves for the three Maritime Provinces. Another has been established at Brandon, in Manitoba, for the Province of Manitoba, a third at Indian Head, in the Provisional Territory of Assiniboia, as an aid to agriculture in the North-west Territories, while the fourth has been located at Agassiz, in the coast climate of British Columbia, where it serves a like purpose for that province.

At all these farms many experiments are in progress in all branches of agriculture, horticulture and arboriculture, and much has already been done towards solving many problems of great importance to farmers and fruit growers. In selecting the sites for the Experimental farms due regard has been had to the great variations in climate in differ-

ent parts of the Dominion, and they have been so placed as to render efficient help to the more thickly settled districts and at the same time to cover the most varied conditions which influence the operations of the farmer and fruit grower in Canada.

Let us first look eastward and glance at Prince Edward Island, one of the most fertile districts in the Dominion. Fruit growing there has thus far been somewhat limited, but most of the orchards which have been planted and looked after with a reasonable degree of care have done well and there seems no reason why the cultivation of fruit could not be much extended there with great advantage to the people. Increased attention is now being given to this subject on the Island, and young orchards are being planted at many different points.

In Nova Scotia fruit growing has made wonderful progress especially of late years, and notably in the Annapolis valley. Eight or nine years ago this industry in Nova Scotia was almost confined to this valley, but since then orchards have been planted in many other districts with much success, and now it is generally held that apples of first quality as well as many other fruits can be grown to advantage in many other parts of Nova Scotia. The Annapolis valley has undoubted and special advantages in the way of suitable soil and shelter, and large crops of beautiful bright colored and high flavored fruits are annually produced there.

Foremost among the apples grown in this favored locality stands the Gravenstein, a handsome, yellow apple, of a delightful flavour and crisp and juicy flesh, which now commands high prices in Great Britain and is much appreciated in Boston and other cities across the border. The Gravenstein is a European apple which originated at a place of that name in Germany, and it is highly prized as a table apple throughout Central Europe. Several years ago a red sport of this apple occurred in the Annapolis Valley, in the orchard of a Mr. Banks, and this apple is now known as the Banks. The beautiful red colour with which this sport is adorned on a yellow ground makes the apple very attractive for dessert purposes. It is singular that a red form of this apple has originated in Germany, and two other forms in Denmark, which are striped with red.

The Gravenstein, from Gravenstein, of the German catalogues, is described as a large, splendid, yellow table apple, of very fine flavour, ripening from October to January. The red Gravenstein is spoken of as similar in size and quality, but red, and the time of ripening is from November to February.

In a European catalogue of Danish apples, the ordinary Gravenstein is said to ripen from October to January. Gravenstein, of Gundestrup, is said to be a large table apple, of excellent quality but striped with red; ripe October to January. There is also a Gravenstein of Tarnborg, which is described as large, of a very fine yellow color, striped with red on those parts exposed to the sun. This is said to be the finest of all table and market apples. It is singular that this variety of apple should have shown such tendencies to sport, mainly in the matter of color, at such widely distant points and under different conditions of climate.

The Baldwin, which is a native of Massachusetts, is also largely grown in the Annapolis Valley, and the trees bear very heavy crops The Nonpareil is another favorite there. This is a russet, of English origin, of good flavor and an excellent keeper. Of late years there have been very extensive additions to the orchards in this valley, and the output of fruit is rapidly increasing. All varieties of apples can be grown there, also plums, pears and cherries.

The Bear River district, which is situated a few miles below the town of Annapolis, is the most noted locality in Nova Scotia for cherry growing. Several years ago I paid a visit there at the time the cherry season was at its height, and was astonished at the number of cherry trees growing in that neighborhood and at the large crops produced. The cherry seemed to be one of the commonest trees in the locality. They were to be found everywhere, in orchards, gardens and fields and even along the roadsides, where the laboring man going to and fro to his work, or the traveller passing through the district, could halt and refresh themselves at will. In looking over some of the orchards

I was surprised at the absence of most of the familiar cultivated forms, and a careful examination convinced me that the greater part of the cherries grown in that section of the country were seedlings of some of the better named sorts. There were among them cherries of every shade of color, and great diversity of foliage. Most of the foliage partook of the Bigarreau type, some resembled that of the Dukes and Morellos, and others again were more or less intermediate in character. The best of the seedlings were increased by budding them on the less desirable sorts and in this way, the average product had been brought up to a good standard of quality. Thousands of boxes of cherries are sent yearly from this district to St. John, Halifax and other cities.

When the Experimental Farm was started at Nappan, N. S., it was the general opinion that fruit would not succeed there, but experience has since shown that apples can be grown successfully not only there, but in many other parts of Nova Scotia, which were at that time thought to be unfavorable for fruit growing. At the Experimental Farm at Nappan we now have under test 288 varieties of large fruits and seventy-five of small fruits. We also have in the ornamental plantations 279 varieties of trees and shrubs. These large plantations are being increased from year to year and are assisting in awakening much general interest in horticulture in the provinces.

Nova Scotia.

Number of varieties of fruits under test at Nappan, N.S., at the close of 1895 :

Large Fruits. Apples, 147 ; pears, 36 ; plums, 41 ; cherries, 39 ; crab-apples, 12 ; apricots, 3 ; nuts, 10 ; total, 288.

Small Fruits. Grapes, 9 ; Strawberries, 20 ; Raspberries (red, white and black), 15; Blackberries, 4 ; Black currants, 3 ; red and white currants, 8 ; gooseberries, 15 ; dwarf juneberries, 1 ; total, 75. Grand total, 363 ;

Fruit growing is also advancing, although less rapidly, in some parts of New Brunswick. The climate of this province is less favorable to the growth of large fruits, nevertheless apples, in many localities, have done well. The growing of late strawberries for the Boston market is quite an important industry in some sections of New Brunswick, for the reason that the cool summer climate enables the growers to place their fruit on the market in first-class condition after the crop in all competing districts is over.

Central Experimental Farm, Ontario.

Much progress has been made in horticulture at this institution. The fruit department at first was in charge of Mr. W. W. Hilborn and subsequently under that of Mr. John Craig. In the report given by Mr. Hilborn of the progress of the work to the close of 1887 he gives the number of varieties of large fruits then under test as 556, and of small fruits 325, total 881, as follows :

Large Fruits. Apples, 297 ; pears, 101 ; plums, 72 ; cherries, 71 ; peaches, 11 ; apricots, 4 ; total, 556.

Small Fruits. Grapes, 127 ; currants, 20 ; gooseberries, 30 ; raspberries (not including 200 seedlings unnamed), 38 ; blackberries, 20 ; strawberries, 90 ; total, 325. Grand total, 881.

Since Mr. Craig took charge of the fruits the number has been largely increased, and the varieties of large fruits now under test number 788 and the small fruits 604, making a total of 1,392 varieties to watch over and take notes of.

The climate of Ottawa is too severe to admit of the cultivation of peaches, apricots or nectarines, or of the finer varieties of plums or pears or of Bigarreau cherries. Nearly all the varieties of these fruits readily obtainable have, however, been tried with the hope that some might be found sufficiently hardy, but they have nearly all failed. Some of the finest varieties of apples have also proven too tender for this district, which, while it is colder than western Ontario, is fairly representative of the settled portions of eastern

and northern Ontario and of the Province of Quebec. The collection at the Central Farm is particularly rich in Russian varieties of apples; also in the improved forms of the native plum. To both of these classes of fruit Mr. Craig has given special attention. Grapes have done remarkably well at this farm and the collection now contains 176 varieties, nearly 150 of which ripened their fruit fairly well last season. A large collection of varieties of English gooseberries has been accumulated which it is now expected can be grown successfully since a remedy has been found for the mildew. Including the American sorts, of which there are not many, this group now contains 128 varieties. This large collection of fruits is very instructive, and Mr. Craig has done much to disseminate some of the large fruits found to be specially worthy by distributing scions to applicants for grafting.

The number of varieties of fruits under test at the Central Experimental Farm at the close of 1895 was as follows:

Large Fruits. Apples (American, 209, Russian, 225), 434; crab-apples, 17; cherries, 94; plums, 166; pears, 55; nuts, 9; peaches, 5; quinces, 4; mulberries, 4; total, 788.

Small Fruits. Grapes, 176; raspberries (red, yellow and black), 110; blackberries, 25; gooseberries, 128; currants, 21; strawberries, 140; juneberries, 4; total, 604. Grand total, 1,392.

The possibilities of extending the fruit growing industry in Canada are almost unlimited, and with ample cold storage facilities so as to admit of shipping to distant points in good condition the markets may be much enlarged and production greatly stimulated.

A large amount of work has also been done at the Central Farm in the testing of vegetables by Mr. Craig.

In the planting of ornamental trees and shrubs excellent progress has also been made at this institution. It is only eight years since this branch of the work was begun, and now in the arboretum and botanic garden (to which sixty-five acres of land have been devoted) together with those other portions adjacent to the buildings which are devoted to ornamental work, a very large collection, numbering more than 1,000 varieties has been brought together for test, and quite a large proportion of them are proving hardy. The results of these experiments will do much to demonstrate the favorable character of the climate of eastern Canada.

(The speaker here showed photographs of views of the Farm and of the trees and shrubs).

It has long been a reproach to Canada that while most of the smaller colonies of Great Britain were doing efficient work in this direction, Canada, one of the brightest gems in the British Empire, with enormous possibilities, had done nothing. This stigma has been removed and a collection worthy of the country is being rapidly brought together, comprising many of the most desirable and beautiful forms from all parts of the world.

Apart from the scientific value of this collection which is very great, the charming effects produced by the judicious grouping of the more ornamental species is of great educational use to the public generally, and the visitors to the farm, who number many thousands each year, carry home with them pleasant memories of these beautiful pictures in landscape art, and many thus become inspired with a desire to beautify and improve their own surroundings, and thus bring these elevating and refining influences to bear on their own households.

One of the most striking features in connection with this ornamental work, is the large number of sample hedges which have been planted. Experiments are being tried with more than sixty varieties of trees to determine their fitness for this purpose. These hedges are arranged in a regular series, each being fifty feet long and ten feet apart. Experiments are also being carried on with all the more valuable timber trees for the

purpose of determining their annual growth in this climate, and the relative time required to produce merchantable timber. Twenty acres of land are devoted to these timber-tree tests.

Lovers of flowers will also find at the Central Farm much to interest them. Apart from the botanic garden which now contains more than 800 species and varieties of hardy perennials, there are special beds devoted to particular plants which are worthy of mention. First, there is a fine collection of that queen of flowers, the rose. Of hybrid remontants there are more than 200 varieties, and of the more tender perpetual bloomers about seventy-five different sorts. The hybrid remontants are cut back before winter to about a foot in height and earth thrown up around the stems to a depth of eight or nine inches and the whole lightly covered with strawy manure from the barn-yard. Under this treatment most of the varieties usually winter well and produce a wealth of bloom in June and July, and more or less flowers from then on to October. There is also a large collection of pæonies, embracing 131 varieties, another of Irises with more than 200 varieties, including a large number of the Japanese sorts, forms of *I. Kempferi* with flowers measuring from five to seven inches across, which seem to stand our climate perfectly. There are also large beds of lilies, including sixty-four species and varieties. Other beds are devoted to pansies, gaillardias, Dianthus, tulips, hyacinths, narcissi and gladioli, and others to mixed annuals and perennials.

A new feature in this branch of the work has lately been started in a series of large beds devoted to the wild flowers found in different parts of the Dominion. One of these is devoted to Ontario, another to Quebec, and others to the Maritime provinces, Manitoba, the Northwest Territories and British Columbia, the object being to show in these beds those species of native growth which are most conspicuous for their beauty and valuable for cultivation.

A conservatory in connection with a propagating and seed-testing house contains an interesting collection of economic plants, orchids and the newer varieties of house plants.

Manitoba.

Passing now by a long stride of about 1,500 miles we bring you to Brandon, Man., where the most easterly of the three western experimental farms is located. Here there are climatic difficulties to contend with which interfere with the successful cultivation of most of the large fruits. For this reason the experimental tests have been mainly confined to the hardiest sorts Since the establishment of this farm 241 varieties of large fruits have been tried, including all the hardiest forms obtainable from Siberia and other parts of Russia, and from other cold climates in northern Europe. These have consisted of

Large fruits, now mostly dead: Apples, 175; pears, 14; plums, 22; cherries, 18 crab-apples, 12; total, 241.

Small fruits, mostly living, except grapes: Grapes, 26; strawberries, 18; raspberries, 29; blackberries, 9; black currants, 22; red and white currants, 13; gooseberries, 24; dwarf June-berries, 1; total 147; grand total, 388.

These tests have been several times repeated during the past six years with the object of testing these fruit trees under various conditions of shelter, but up to the present time very little success has attended the efforts made. We have succeeded in fruiting several varieties of the wild plum, which is native in some parts of Manitoba, and is perfectly hardy, and much attention has of late been given to the securing of such improved varieties of the wild plum as have been originated in the north-western States, especially in Minnesota It is believed that in a short time an orchard consisting of these improved forms of the wild type can be successfully established, and that these varieties of fruit will be very acceptable and useful to the people.

No success worthy of mention has yet attended the testing at Brandon of any of the hardy varieties of apples, nor of any of the crab-apples grown in the east. There is, however, one wild crab, a very small one with fruit about the size of a cherry, which was

obtained from the northern part of Siberia, which has stood the climate perfectly for the past four or five years, and during the last two seasons has borne some fruit. Experiments are now being conducted with the object of improving this fruit, and in 1893 this Siberian variety, known as the berried pyrus (*Pyrus Baccata*), was cross-fertilized with pollen from some of the hardiest varieties of apples, such as Duchess, Tetofsky, Wealthy, Yellow Transparent, and Anis, also with pollen from the Hyslop and Transcendant crabs. The seeds obtained from these various crosses were sown, and we now have about 150 one-year old trees as the result of this work. It is hoped that in four or five years when these young trees come to fruit, that there will be found amongst them some improved forms such as will be serviceable to the people of Manitoba. This is slow work but it is being prosecuted with as much haste as nature will admit of.

Sand cherries have also succeeded well. Among these there are promising forms from different sections of the country which vary much in size, colour, and quality, some of them being very good and serviceable.

A fair measure of success has attended the experiments with some of the small fruits, of which 147 varieties have been tested. The most successful have been the red, white and black currants, and gooseberries, and also the hardier sorts of raspberries. Strawberries have been a partial success, but all attempts to grow our eastern varieties of grapes have thus far failed. Examples of the wild frost grape found growing in the Red River valley have of late been secured and planted, and it is hoped that eventually some improved forms of this fruit may be obtained from that source.

A much larger measure of success has attended the experiments with ornamental trees and shrubs, and there are thus far about 100 species and varieties which have proven hardy at this farm. Every year some additions are being made to this list, which will, no doubt, in time assume goodly proportions and give to the people of Manitoba sufficient material for the beautifying of their homes, not only in the cities but also on the prairie farms.

The North-west.

Another step of 183 miles brings us to the next experimental farm at Indian Head in Eastern Assiniboia, one of the Northwest Territories. While this is one of the finest grain-producing districts in the whole northwest the conditions of climate which prevail during the winter and early spring are, I think, less favorable for tree growth than those of Manitoba. A similar line of experiments to those conducted at Brandon have been carried on here with large fruits, involving the testing of 203 varieties of large fruits, nearly all of which have failed, and 127 varieties of small fruits, a part of which have been successful.

Large fruits, tested at Indian Head, mostly dead: Apples, 154; pears, 9; plums, 14; cherries, 14; crab-apples, 12; total, 203.

Small fruits, mostly living, excepting grapes: Grapes, 26; strawberries, 16; raspberries, 26; blackberries, 4; black currants, 16; red and white currants, 14; gooseberries, 23; miscellaneous sand cherry and dwarf June-berry, 2; total, 127; grand total, 330.

The successes referred to at Brandon with the *Pyrus Baccata*, the Manitoba wild plum and the sand cherry have been repeated here. Many varieties of currants, gooseberries and raspberries are cultivated with a fair measure of success. The proportion of failures to successes in the experiments with strawberries have been very large, while grapes have thus far failed entirely. In the growing of ornamental trees and shrubs the success has been encouraging, and we now have upwards of ninety varieties which have proven hardy at this farm.

British Columbia.

We now skip over 500 miles of plains and another 500 miles of mountains and find ourselves in the coast climate of British Columbia, where the most westerly of the experimental farms has been located, about seventy miles east of Vancouver. Here the climate

is mild, and much resembles that of some parts of England, and the apple, pear, plum and cherry thrive wonderfully well and produce abundant crops. Since fruit culture promises to become one of the most important industries in this province, a very large number of varieties have been brought together for test, nearly all of which are doing well. The test orchards at this farm now contain, I believe, the largest number of varieties of fruit to be found in any one place in the world.

At present the large fruits number 1,204, and the small fruits 393 varieties, making a total of nearly 1,600 different sorts, and when the orders for the coming year, which have been placed in Europe and the United States, are filled, and some additional varieties sent from the Central Farm, the number will exceed 2,200 in all.

The number of varieties of fruits under test at Agassiz, B.C., at the close of 1895, were:

Large fruits: Apples, 508; crab-apples, 28; pears, 154; plums, 176; cherries, 86; peaches, 159; apricots, 22; nectarines, 15; figs, 15; quinces, 5; medlars, 3; mulberries, 8; nuts, 25; total, 1,204.

Small fruits: Grapes, 101; strawberries, 98; raspberries, red and white, 41; raspberries, black, 18; blackberries, 29; black currants, 37; red and white currants, 23; gooseberries, 42; miscellaneous, 4; total, 393 Grand total, 1,597.

For profitable growing in that climate I would place plums first, which bear wonderfully heavy crops, followed by apples, pears and cherries, all of which do well. Peaches, apricots and nectarines have not yet given satisfactory results, although the trees usually come through the winter well and more or less fruit is borne. Figs, quinces and medlars have been tried for several years without much return; the trees, however, are young yet. The larger mulberries have produced excellent crops. Many varieties of nuts are under test, and most of them are doing very well, some of the filberts having borne good crops for the last two years. The English and Japanese walnuts, the Spanish and the improved varieties of American chestnuts, and a number of varieties of almonds are all making good progress and promise well for the future.

In addition to the large orchards which have been planted in the valley land on this farm, four orchards have been set out on the bench lands on the side of the mountain at the back of the farm. These have been planted at different heights from 150 to 1,050 feet above the valley. The trees and vines on the mountain side have made excellent growth and they are earlier in blossoming in the spring and in maturing their fruit in the autumn than those planted on the level, This is a very important experiment for that province, for the reason that there is a very large quantity of such bench land which is of no value for the purposes of general agriculture and when it is fairly proven that fruit can be profitably grown in such locations a great impetus will be given to this industry.

With a climate so favourable as to permit of the wintering of the Rhododendron, European Holly, Yew, Laburnum and the Laurels, it is not surprising that a very large number of ornamental trees and shrubs succeed there, and this we have found to be the case. Some 500 or 600 species and varieties have been tested already and many others are under trial

Experiments are also being carried on with forest trees, especially with the more valuable hardwood timber trees of the east, with the object of ascertaining whether these useful species will grow to advantage in that climate. British Columbia with all its wealth of timber has scarcely any hard-woods. None of the most valuable eastern species being represented in that country. About twenty thousand young trees have been planted on the mountain bench lands, consisting mainly of black walnut, ash, elm, hickory, oak, wild cherry and butternut and many of these are growing well. If they succeed and grow as rapidly as other timber trees in that climate, this will be a great incentive to the planting of these useful species on a larger scale with the view of eventually supplying the needs of British Columbia in this particular.

From this somewhat hurried summary it will be seen that much progress has already been made in horticultural work on the experimental farms and much more is being planned. To some whose eyes have not been opened, or whose senses have been blunted by the pressing cares of life or the greed of gain, nature is almost a sealed book. They see but few of its beauties, enjoy little of its pleasures, and often look on the expenditure of money on such objects of interest as wasteful. Are not these lovely shrubs and trees and flowers which combine so much grace and beauty and which afford such quiet delight to all lovers of nature, expressions of the thoughts of the great Creator? He has established and sustains the laws which govern their growth and which bring about those marvellous changes in form and in color which have given us some of the most beautiful things we have in cultivation. Who would be so presumptuous as to say that what the Creator has made and pronounced good is not worthy of man's attention and study? On the contrary, I would say with the old writer "What God has thought it worth His while to create is worthy of man's careful attention and enquiry." These objects afford us pleasing lessons for contemplation at all times. We may allow our thoughts to dwell on the seed with its store of nourishment laid up within, with which to feed the young germ when favorable conditions call it into active life, and which serve to sustain it until the roots are sufficiently developed to gather food from the soil. We may study the young plantlet when it first appears above ground and watch from time to time its growth and progress to maturity. Can we not learn lessons of wisdom from the wonderful system of circulation it has, by which the elements of nutrition are taken in by the tiny rootlets and carried from thence to the leaves to be elaborated and fitted to serve its purpose in the gradual building up of the structure. Further, from the admirable manner in which the bundles of woody tissue are put together, which give strength to the tree, which enables it to resist the force of wind and storm, and also to form timber of different degrees of strength and of various textures suitable for man's use. We may also study with profit the wonderful arrangements whereby the exhalations of animals, which would otherwise soon poison the atmosphere, are taken up and appropriated as food by plants, and the stores thus made and laid up in the tissues of the plant become again suitable and nourishing food for the animal, and thus the wonderful circle of harmony between the animal and the vegetable world is maintained. We may also study with profit the wealth of grace and beauty displayed on every hand, which captivates and refines the mind and leads us from nature up to nature's God.

Let it be the aim of this useful Association to strive to elevate the tastes of its fellow-citizens, first, by cultivating the very best sorts of fruits, with which to supply their tables, and next by assisting them to introduce into their gardens and about their houses some of the very beautiful forms of trees and shrubs which have been shown to be hardy in our climate. Let them grow as nature has intended them to do, and gradually develope their special forms of beauty without mutilation. Then those who see them will not long lack that inspiration which will prompt to imitation, and thus the good work will progress, extending its refining influences far and wide, and diffusing happiness and contentment among its possessors. Let us not forget the lesson taught us by the great Master in that remarkable sermon on the Mount when He gazed on the beautiful lilies growing about Him and said: "Consider the lilies; for I say unto you that even Solomon in all his glory was not arrayed like one of these."

The meeting closed at 10.30 by singing the National Anthem.

SECOND DAY—MORNING.

By the courtesy of the local Horticultural Society and the Mayor and the corporation of Woodstock, the delegates to the convention were driven through the town.

At Woodstock College the delegates took particular pleasure in inspecting the work of the manual training department, which was in full swing, the students working in wood and iron, and all the machinery being in motion. The physical science department

also excited considerable interest. An elaborate luncheon was served, and at its conclusion Principal Bates voiced the welcome of the management of the college to the delegates, making allusion to the similarity of the work of the college and of the Association in regard to the soil, best methods of cultivation, nature of the seed sown and of the fruit expected, the atmosphere, etc.

Mr. G. R. Patullo, County Registrar, responded on behalf of the local association. He referred to the way in which Canada, at the World's Fair, distanced all competitors in the fruit department. In cheese making, which had been learned from our American friends, Canada had shown at the World's Fair, that in this, as in many other institutions the pupil had excelled the teacher. We beat them at their own game, so to speak. (Applause and laughter.) We have been suprised to learn that Ontario is such a splendid fruit-growing district; the truth of the matter is that none of us had realized it until the wonderful success had been achieved. Ontario had been represented as a good place for skating and tobogganning, but it was not supposed that it could compete with the great States of the Union, such as California and Florida, in fruit growing; but it is proven that even in that respect we can surpass the Americans. (Hear, hear.) He had been delighted with the meeting thus far, and surprised at the extent and variety of the discussions. They had disposed of mice and vermin of all kinds in connection with the fruit trees; they had disposed of the potato bug and the bee; but there was one subject that they seemed to struggle with in vain, and that was the truthless tree agent. (Laughter.) He seemed to stagger them all. Here was a great field for missionary enterprise. (Laughter.) He concluded by thanking the College authorities for their generous entertainment.

Hon. John Dryden was next introduced as Minister of Agriculture and a Governor of McMaster University, of which Woodstock College is an academic department for young men. He spoke favorably of the institution and eloquently advocated a liberal education for farmers' sons. In his opinion there was nothing in a true education that should drive men or women away from industrial pursuits.

Messrs. M. Pettit, W. E. Wellington and Prof. Saunders also spoke along similar lines. After a chorus by the college boys, the delegates repaired to the Town Hall for the afternoon session.

SECOND DAY—AFTERNOON SESSION.

Convention resumed at 2.30 p.m., Mr. A. H. Pettit being asked to take the chair.

QUESTION DRAWER.

Question: What four varieties of peaches would you recommend for this locality?

Mr. J. W. Smith: Considering it a cold locality, pretty high, I would recommend Early Rivers as the best early peach and Hill's Chili for a later peach. Probably the next best would be Garfield; with us it has done better than Early Crawford. I would name Crosby for the last one; it comes in about the time of the late Crawford; it is a smallish peach and good flavor.

Question: In planting an assortment of two hundred young apple trees what kind would you recommend and how many of each variety, local and foreign markets considered?

Mr. Dempsey: I would put in about twenty Duchess, about twenty Wealthy, about twenty Gravensteins; the balance I would equally divide with the Ontario, Ben Davis and Stark.

The Secretary: Is the Stark an abundant bearer?

Mr. Dempsey: Yes.

The SECRETARY: Is it a good shipper and seller?

Mr. DEMPSEY: Yes; it has a better flavor than the Ben Davis, I think, and keeps fully as well.

The SECRETARY: What about the Ontario?

Mr. DEMPSEY: The Ontario bears so heavy it is very apt to run a little small without thinning the fruit.

The SECRETARY: Is it subject to scab?

Mr. DEMPSEY: I have never seen any scab on them.

Mr. RICE: Is the Ontario a seedling of the Spy?

Mr. DEMPSEY: It is one of Charles Arnold's seedlings, of Paris—a cross between the Wagener and the Spy. It has the bearing qualities of the Wagener; it is more acid than the Spy and keeps fully as well.

The SECRETARY: In this connection I would mention the Cranberry Pippin, which for southern Ontario is a very good market apple. It is of ordinary quality, but it is a showy apple and a good bearer, and it has borne heavy crops when many other varieties did not bear. Even the Baldwin failed to produce, and this apple produced freely; that is why I thought a good deal of it.

Mr. CASTON: I would like to draw attention to an apple from the eastern end of the province called the Fallawater. In the county of Simcoe it is a perfectly healthy tree, an abundant bearer and clear of fungus scab. It is a handsome apple. It was quoted in Liverpool this fall at 17*s.* a barrel. It is firm fruit, good shipper and good cooker.

Mr. RACE: It has no quality.

Mr. MCNEILL: 17*s.* is the quality.

Mr. RACE: They will give that until they find out what it is.

Mr. DEMPSEY: My experience is that I can grow more Baldwins than Fallawaters. The latter drops prematurely with me.

Mr. SHERRINGTON: The Fallawater is not an annual bearer with us; only about once in two years we get a crop. It is really a fine apple, but I do not consider the quality equal to our other winter apples. In cooking it does not fall down like the Spy, Baldwins, Greenings; it will be about the same as the Ben Davis, and its season with us is about the end of March.

The SECRETARY: I think it will be best that the balance of the questions be referred to a committee, as they are of such a nature that they would occupy the whole afternoon in discussion. They go into great detail with regard to the best varieties of every sort of fruit and the best methods of planting them. Many of these points were brought out in yesterday's papers and discussions.

SPRAYING AND THE CULTIVATION OF ORCHARDS.

Mr. J. C. HARRIS, of Ingersoll, read the following paper:

I am here to-day with the desire to listen to your discussions and to gain information on questions with which you are much more familiar than myself, rather than with the expectation of giving you any instruction. The topic before us, "The spraying and Cultivation of Apple Orchards," is an important one. I do not purpose in this paper to go into details, but rather to give a few general points apt to be overlooked by the amateurs. First, let us look at a few causes why apple culture is not more generally successful. A tree when young, like an animal should always be kept growing, and how best can we accomplish this? After having our orchards well set out, having due regard to location, drainage and richness of soil, the surface earth about the tree should be kept stirred once every two weeks or oftener, especially in very dry weather. I consider this

superior to either mulching or watering, and have seen young apple trees first year planted treated in this way make two feet in one season. If one has not the time for this I consider mulching next best. But for the healthfulness and vigor of the tree I consider the former practice much superior, especially the first season, as it keeps the soil moist during the severest drouth, and also allows the sun's action upon the soil, while mulching only serves to keep the soil moist. This practice also of shallow cultivation adds materially to the size and quality of the apple after the tree comes into bearing. We occasionally see productive orchards standing in sod. This only proves the land is unusually rich ; as a rule this is not the case. Seeding down an orchard for a few years in some cases may prove beneficial, but the majority of orchards contradict this experience. Cultivation should begin in the spring as soon as the ground is fit for work and discontinued in August to give the tree time to mature its wood before the coming hard frosts.

Another most important point to be considered, what shall we feed our trees? The question of what the orchards require to form wood, leaves and fruit is one for us to study. We are told the ash of fruits contains from fifty to seventy-five per cent. of potash and only a small proportion of other ingredients, which certainly proves that potash is the principal one taken from the soil by our various fruit crops. Unleached wood ashes contain a very large percentage of potash, we are told from twelve to fifteen cents' worth in a bushel, beside from six to ten cents' worth of other ingredients. Therefore if we can purchase these at from nine to twelve cents per bushel I do not think we can get a cheaper fertilizer for our orchards. Stable manure, where available, applied in combination with the ashes would certainly prove beneficial, but should be withheld if there proves to be too much wood growth at the expense of fruit. If we neglect to feed our trees we must come to the conclusion apple growing does not pay. Another point we will look into is pruning. The tree should be kept symmetrical and open from its youth, never allow a year to pass without performing this important operation, which will prevent the need of removing any large limbs which is certainly detrimental to the tree's welfare. Boots made from some soft material such as rubber should be worn while pruning, not to loosen or remove any bark from the limbs by standing upon them.

Be very careful to encourage and protect fruit spurs when pruning and also picking. These little twigs or spurs along the limbs is just where we find some of our choicest fruit. Some time ago an old man who has made a business of pruning for many years in our locality came into my orchard and asked for a job of pruning. So I thought it a chance perhaps of getting some new idea on the subject. He took the saw and commenced cleaning the limbs of all their fruit spurs. I can assure you he did not continue very long. I know of no better way of encouraging the growth of these fruit spurs than shallow cultivation and the use of wood ashes, and I think as a rule a tree filled with these spurs will before long be filled with fruit. I will here give you my experience in spraying in 1894. The May frosts ruined the crop of 1895. Having had but the one season's experience my practical knowledge is but limited. However, I can say with me it has proven a decided success for the prevention of apple spot or apple scab, and the destruction of the codling moth. How often the failure of the crop of apples or pears is laid at the door of the weather clerk when if a close examination had been made the presence of fungi or insects sapping away the plant life would have been discovered, and a timely application of the various methods of prevention and remedy now known would save a large proportion of our product from their attacks.

First let us consider the various remedies which have proven the most effective and practical in our warfare against these diseases and insect pests. The Bordeaux mixture, composed of copper sulphate six pounds, quicklime four pounds, water fifty gallons, is the one most commonly used, and has proved very effectual in preventing the black spot or apple scab.

Paris green or London purple, in the proportion of a quarter of a pound to fifty gallons of water, or in the same quantity of the Bordeaux mixture, has been found sufficient to destroy the codling moth or tent caterpillar. Paris green is entirely insoluble in water, hence, in its application, some means must be resorted to in order to keep the mixture

well stirred. I will here give you as near as possible the percentage of marketable fruit gathered from three different orchards, each having had a different number of the above remedies.

No 1 is a young orchard sprayed five times which turned out an abundant yield of nearly perfect fruit, not over five per cent. being unmarketable. First application just as buds began to swell: Six pounds copper sulphate, fifty gallons of water. Second application just before blossoms opened: Bordeaux mixture and London purple. Third application just before blossoms fell, with the same. Fourth a fortnight later, same. Fifth three weeks latter, same.

Orchard No. 2 was treated same as No. 1, with the omission of first application of copper sulphate. The results from this orchard were considerably behind the first one, although about the finest crop 1 ever had.

Orchard No. 3 was sprayed twice, once before blossoms opened and once just after they had fallen, with the same mixture as the others. I consider this one paid handsomely for the outlay, although there was probably twenty or twenty-five per cent. unmarketable. I do not feel justified in saying the difference in orchards, No. 1 and 2, was wholly due to the first application of copper sulphate; orchard No. 1 being much younger and not containing Spys or other kinds most liable to be affected by scab, had much to do with it. However, in my opinion the application before blossoms opened is of fully as much value and possibly more than the subsequent ones in preventing these fungous diseases. Again, orchard No. 3 had the two and three applications and was comparatively free from scab, but was seriously affected with codling moth. Now what do we naturally gather from reviewing the results of the different number of applications in the three different orchards.

First, that the first application before blossoms opened is of fully more importance for the prevention of fungous diseases than the later ones; also that it requires a series of applications of insecticides to successfully cope with the codling moth. I might say just here, in orchard No. 2 a few Spy trees were sprayed on one side only. The other side, which was more favorably exposed to sun and air, had scarcely a marketable specimen on it. The side treated was laden with beautiful fruit.

As to the preparing of the Bordeaux mixture: Have one large barrel for the copper sulphate, another for the lime, put in a coarse sack the number of pounds of copper sulphate you wish to dissolve; suspend it in barrel No. 1, containing half the number of gallons of water that you have pounds of copper sulphate. If any remains dissolve it in some hot water. Then every gallon of the mixture contains just two pounds of copper sulphate, which makes it in a convenient form for use. Fresh lime should be slacked, strained through a fine sieve and a No. 2 barrel filled with it in such a proportion that every gallon contains just two pounds of lime. This is easily done by weighing the lime before slacking, and using one-half the number of gallons of water there are pounds of lime in slacking it. Now take three gallons of copper sulphate from barrel No. 1 and two gallons of lime from barrel No. 2 and put them in the barrel we use for spraying; fill up with forty-five gallons of water, mix well and our Bordeaux mixture is ready for use. Add four ounces of Paris green or London purple for destruction of codling moth. I might add that for spraying high trees, use a ladder made of two by four scantling, fourteen feet long, fastened to back end of spraying waggon. A man getting on the top of this ladder can do the work almost perfectly, and much more easily than by holding the nozzle on the end of a long pole or rod, as is sometimes recommended.

In conclusion, I will mention some of the most important points to be remembered in spraying:

1. Have a good outfit with not less than eighteen feet of hose to reach the top of ladder for treating very high trees.

2. Keep the liquid well stirred or your efforts will be fruitless.

3. Be sure and start in time. Do not wait for the weather. I will here relate a little circumstance which occurred the past season: I sprayed some red currant bushes before a very heavy, dashing thunderstorm. I could not find a currant worm on the

bushes the rest of the season. About a rod from these was a few gooseberry bushes unsprayed; the worms ate every leaf from them. The Bordeaux remained on bushes for three months.

4. Be sure your lime is fresh, and put in fully four pounds.

5. Get formula for Bordeaux mixture from a reliable source. Do not depend on the circular you get with your pump; some of them are worse than useless.

6. Remember the June spraying, just after blossoms fall, is the most important for the destruction of the codling moth, and do it thoroughly.

Spraying may not protect against all the effects of a late frost or a long, continuous rain, but it helps. Anything that strengthens a tree or plant in one direction increases its resistant powers in another. There are other ways in which the results are beneficial besides those mentioned.

The leaves of our trees when affected by the scab fall prematurely, carrying with them much potash, a potash acid, a direct loss to the strength of the tree. Now, if the leaves can be made by spraying to hold fast until the proper time for maturity of growth their fertilizing constituents will be withdrawn from the leaves into the body of the tree, and there be stored up for the following year.

EXPERIMENTS IN SPRAYING IN 1895.

Mr. A. H. Pettit said: I have been conducting the spraying experiments throughout the province during the past season, and was waiting to get the final returns, and make a report that will be satisfactory and which will be published in some of our reports. I can simply now give you a synopsis of the work we have done, and the results. The first intimation we had of this work was through the Honorable the Minister of Agriculture. It appeared to him that some good work could be done throughout the province to assist the fruit growers, by sending out three spraying outfits, so that our fruit growers might see the work in operation and also the results at the close of the season. The work was entrusted to me, and our plan of operation was to touch those centres of fruit culture where a large number of people could have an opportunity of seeing the work during its progress, and of noting the results. One of our drawbacks was the peculiarity of the season. As many of you know, we jumped as it were from winter weather to warm summer weather, hastening the budding and blossoming of the fruit. In covering so wide a territory the work had to be done at the exact moment, in order that we should not be too late at the other end of the route which each outfit had to take. We commenced in the county of Essex and went through to the county of Welland, visiting ten points; then we commenced in the county of Lambton and round the Georgian Bay district to the county of York, Newmarket, as a second division, ten places; then we commenced at Whitby, in the county of Ontario, through as far as Cornwall and the county of Dundas in the east, ten places. Three outfits travelled that territory throughout the season, covering it in every case in twelve, and in one case I think, thirteen days for each round. Now this spraying experiment was thoroughly, practically and fully done as laid down in the bulletins or our Agricultural College and of the Experiment Station at Ottawa. It was simply carrying out what they stated would destroy the fungi and prevent the codling moth from injuring our fruit to any extent. I purchased the best quality of copper sulphate that could be got in the country. It was all in one cask, and it was all weighed from that cask for the whole territory. The Paris green was dealt with in the same manner. It was of the best quality we could get, and was weighed by the druggist in four ounce packages, just the quantity we intended to use each time; and that also covered the whole experiment, so that it was not using a little Paris green here and a little of another brand there, a little less quantity here and a little more quantity there, but we carried out the experiment exactly as laid down in these bulletins. In going through the territory early in the season to make the necessary arrangements I was exceedingly pleased with the enthusiasm and satisfaction with which I was received

by the fruit growers of those district. In many instances we had no less than 100 people present to co-operate in carrying out this work. The work was thoroughly done. We have a large number of pump manufacturers in our country who are manufacturing spraying pumps. I asked them if they were prepared to supply pumps to the various points throughout the province. They said they were, and that they had excellent spraying pumps. I then told them that I wished them to prove to me that they had spraying pumps that would do this work thoroughly and well, and in order to convince myself of that I asked them to bring those pumps to my own place and give a practical demonstration. They brought their pumps. I furnished them with fifty gallons of the Bordeaux mixture, and told them that the mixture had to be applied evenly and thoroughly to the tree; that would test not only the pump but the nozzle, and test the excellence of the pump as to agitation. "You must keep the liquid thoroughly agitated" I said "during the whole work; unless you do so the work can never be done perfectly." They brought their pumps and the mixture was applied; and then I wished to draw their attention to a little dinner or something of that kind in order to allow the sun to dry the spray on the trees, and afterward I invited them back to the orchard to see the work their pumps had done. The first four or five trees were thoroughly covered with the lime of the Bordeaux mixture, but later on there was no show Now, I believe that was the first time some of our pump manufacturers realized what the real work was which their pumps had to do. I said that must not be; there must be more agitation. Now since that time those gentlemen have improved on those pumps till I believe we have in the province of Ontario as good spraying pumps as can be found manufactured in the world. (Hear, hear and applause).

It was simply that they should know what their pumps were actually capable of doing. There is no use of our deceiving ourselves by putting this liquid into a barrel, allowing it to settle to the bottom, pumping it out in a round stream like that with a "Boss" nozzel, letting it all run off the trees, and then in the fall of the year saying "I don't see the results of the work that was done." It must be evenly applied, covering it like the dew, so that every part and parcel of the tree would be covered with this mixture. It must be done at the proper time and in a thorough manner. I think you will all appreciate the great advantage it would be for all our fruit growers to carry it out on that line. We commenced on the 24th of April and we finished on the 20th of July. We gave six applications at each point. When we got to the other end we immediately come back to where we began and passed over again—the ten points covering ten days, the only hindrance being two Sundays and holidays, except at the time of the third application, when I called my assistants in for two days for fear the blossoms had not fully matured and were not falling sufficiently from the trees, lest our bee men might have complained that we were pushing the matter rather hastily At the end of the season I visited each and every one of those points. What result did I find? In some sections of the country where the frost was very severe just at the time that the blossom was fully out and immediately following a drouth our results are not so marked as I would like to see, though we had some results even in those cases. We have got the best of results throughout the whole territory except in two or three points. Now, in what line is that best result shown? First, it is shown in the healthy appearance of the foliage—foliage more vigorous, and we all know what that means in a fruit tree; if we have vigor in the tree and good healthy foliage we may expect good fruit buds to set, and we may expect possibly better results from the work of the next year than we would have this. The next point was in the cleanness and the perfectness of the specimens of apples. At nearly every point that I inspected you can see an increase in size, cleanness of specimens, and in many cases much larger crop than where the trees were not sprayed. You all know that this year the frost and the drouth continuing had its effect in many ways; and I believe that the frost assisted in destroying the fungi as well as insect enemies, and for that reason the difference between the unsprayed and sprayed was not so marked as it would have been in almost any season during the last ten years. Throughout the season I kept and had the experimenters keep a book in which certain questions were asked, and they had to fill them out each day. These were, the condition of the orchard, the solution applied, the weather on the day of the application, and the general

appearance each day they visited and did their work, not only of the trees that were sprayed but of the trees that were unsprayed. The solution was applied in fair weather, no rains to wash it off, and we should have had the full results of that experiment. I want to offer one suggestion, and I think every one will agree with it, although we have been doing it the other way. It is supposed that our first application should be the copper sulphate solution only—four, five or six pound as the case may be. I notice some of the bulletins claim it is better to use six, and some four, but I used four throughout this work. Now I would suggest that every solution in the future on the apple—I won't say other fruits—should be the full Bordeaux mixture, because in many parts of our province our people are being troubled more or less by the bud moth, and it would be an advantage if we could prevent the bud moth by using the Bordeaux mixture in the first application. The second reason is that the Bordeaux mixture will not hinder the work of the copper sulphate; it will do its work just as well as if it was applied alone. We can also destroy any other insects that might be injurious to the tree during the application. The only addition would be the slight cost of the lime and Paris green; it will be a trifling matter in comparison with the good work it might do.

Mr. McNeill: Do you mean the Bordeaux mixture or do you mean the Paris green with the sulphate of copper?

Mr. Pettit: I mean the full Bordeaux mixture—a little of the copper sulphate with the addition of the Paris green; that the full application should be given every time.

Mr. Caston: That is to bare trees?

Mr. Pettit: To the trees from start to finish.

Mr. McNeill: To the dormant wood?

Mr. Pettit: Yes The lime will fasten the Paris green and copper sulphate to the tree, and that may destroy the bud moth at the start. I would like to say a word on another subject—the question of cultivation. I have travelled over this province several times, and have been a fruit grower all my life, and I have observed marked results that follow good cultivation. I believe in ninety-nine cases out of a hundred the man who plants his orchard with good judgment in selecting varieties, and cultivates it well, and has heart in the work, will succeed and make it pay well. I won't say there is no instance where a man has never cultivated his orchard and yet had good crops; but the man who cultivates his corn or any other crop is the man who will profit by the business, and he is a credit to his country. Unless we cultivate, prune and handle our orchards in that way we never can get perfect specimens of fruit. I have brought these two apples up to illustrate what I mean. Unless the tree is well grown and thoroughly pruned, so that the sunlight of heaven can get in, you cannot have the quality and the color in your fruit. Here is an apple that has the quality, and that will bring you money every day, while this other is an apple that will neither be a a first-class keeper nor have the quality. It cannot have quality without the color. (Mr. Pettit exhibited two Northern Spy apples, one of a very high color and the other very dull, as proofs of his argument). Another point we need to find out when we go to plant an orchard is: Where is the home of that apple? I find in the northern sections of our country apples of a high keeping quality and producing abundantly. Why is it? Simply because it is the home of that apple. If we can locate a variety in its right place that is the variety we should plant, and the one that will be successful. I am frequently asked to recommend varieties for certain localities. I think a man in that locality should visit the orchards in his neighborhood, study the question himself, the soil and climatic conditions, and plant that which will be hardy, and he will not go astray. At these annual meetings we have an opportunity to study and exhibit and show and explain. You get the views of all the different sections of the province. I always think there is most excellent reading between the lines, and we want to do that as well as reading along the lines. One more word about this pump question: I am asked a thousand times which pump I would recommend after having used five manufacturers' pumps. Now, gentlemen, I will tell you what you want in a pump: You want a pump

with plenty of power; you want a thoroughly good nozzle, one that will apply this mixture in a fine spray to your trees, and a first-class agitator; and when you have got these never mind who is the manufacturer; if he furnishes these you have got a good pump, and as far as capabilities go you are as well able to judge that as I am. I would say this to the manufacturers: Don't be trying to manufacture a cheap and nasty pump, because you will do more injury to our cause than otherwise you could do. When a man goes to spray in a busy time and his pump gives out, it discourages him, and it ends in disaster all around. I say to the manufacturers: Manufacture a first class article, the best you can make, and I believe our fruit growers as a whole will be better satisfied with it than if they got one for fifty cents.

The PRESIDENT: The subjects that have been presented to you in the paper and in discussion, are before you. I shall ask Prof. Craig to open the discussion.

Prof. CRAIG: It afforded me a great deal of pleasure last year when I was made aware of the proposed action of the Provincial Government through the Minister of Agriculture with regard to the carrying on of spraying experiments which had been started during the previous year, and I was especially gratified to know that such an admirable selection had been made in the man who was to do it. After the magnificent success which Ontario achieved at the World's Fair under his oversight there was not much difficulty in making a choice of the man who has carried this work on to sucessful completion, and after the report we have from Mr. Pettit to-day I think that choice was perfectly justifiable. Last summer in a trip through the western part of the province, I visited with Mr. Pettit some of the stations at which he carried on his work, and I wish to corroborate in a general way the results he has stated. I found in Essex County in the orchards treated, the insect depredations were very much lessened and the quality of the fruit very much improved. We had excellent opportunities for observing these points, because in nearly every case there were orchards alongside that had not been treated, and also in the same orchard some of the trees were not spraved. The work was carried out on a perfectly practical basis, and in a way to give definite results. In regard to the formula used I don't think it is necessary for us to use more copper sulphate than the results of our experiments in the past, show to be needful. We have very conclusive results to show us that four pounds of copper sulphate and the same amount of lime are as effectual as using more, which only increases the expense. I wish to pay a tribute to Mr. Harris' paper, for it showed the result of careful individual research, and that is what we need not only on the part of the experimenters, but of individual fruit growers throughout the country, who can by the result of these practical experiments strengthen the hands of special investigators who are appointed for the purpose. After my experience in spraying for five years I don't think it necessary to use a stronger formula than that used by Mr. Pettit in his work during the past season, and that which is recommended by both Guelph College and the Experimental Farm at Ottawa, viz., four pounds of copper sulphate and four pounds of lime; and when we add four ounces of Paris green to a barrel of water, about forty gallons, we have a formula easily remembered and very efficient.

Mr. SMITH: Would you agree with Mr. Pettit in recommending a full application?

Prof CRAIG: The copper sulphate as the first application was recommended with a view of destroying the apple spot only, and it was recommended because it was more easily applied and was much cheaper than the Bordeaux mixture. At that time we did not have in mind the destruction of this very injurious pest, the bud moth, which has been spreading over the province, and which is annually becoming more destructive; and I quite agree with Mr. Pettit that with the view of destroying that insect and other insects, such as the cigar-shaped case bearer, the Bordeaux mixture with the addition of Paris green for a first application would be more satisfactory. It is really the same amount of copper sulphate, because we use four pounds to fifty gallons in one case and two pounds to twenty-five gallons in the other; it is only the addition of the lime and the additional inconvenience of applying it.

Mr. BEADLE: Lime makes it adhere a great deal better.

Prof. Craig: Yes, and everyone who has used lime in destroying fungous pests where the same attack plants will find it exceedingly useful. It may interest you to see a photograph which I took of a spraying apparatus which I have used at the Ottawa Farm, and which is especially useful in orchards where the trees are rather close together. It is simply a barrel set in an ordinary dump cart, and the barrel is stood on end, and the cart is floored over on a level with the top. That floor holds the barrel in place, and also gives the man a platform to stand upon who is operating the spraying. (Photograph exhibited.) In connection with the experiments for the prevention of disease which effect our grape vine, I have a couple of photographs which represent two vines of the same variety in the Experimental Farm at Ottawa; one which was sprayed for the prevention of a disease which we know as the "bird's-eye spot," and the other which was not sprayed. In one case the foliage is so dense that you cannot see the fruit; in the other case the vines are entirely defoliated, and what little fruit still remains can be plainly seen. These little object lessons I leave in the vineyard for the benefit of visitors, and they are often more conclusive than any feeble words which I may be able to offer. I am exceedingly pleased to see the active steps which the Provincial Government have taken in this matter, and the practical manner in which the man who has charge of it has carried it out.

Mr. Pettit: I want to tell you how that wonderful work at the World's Fair was accomplished, for the glory does not all rest on my shoulders by any means. The satisfactory result was achieved by the patriotic assistance of the fruit growers of the Province of Ontario placing in my hands fruits that the judges who were appointed had to score as they did, and that is the way you got the rewards, and not all through my efforts in the matter. I thank you for your flattering remarks, but they were getting a little too thick. (Laughter and applause.)

Mr. W. E. Saunders (London): Bordeaux mixture has been recommended with the addition of Paris green, for the destruction of the bud moth. Of course Paris green destroys the bud moth. Why should not sulphate of copper, the solution of which is more easily applied, and which perhaps is more active in destroying the fungus spores as they lie on the tree, be added to the Paris green instead of the Bordeaux mixture?

Prof. Craig: Mr. Pettit's idea in recommending the Bordeaux mixture was that, with the addition of lime, you have the Paris green on the trees for a longer time. The copper sulphate, I suppose, being in a dissolved form when it is put on, is therefore the more readily washed off; and it would be natural to suppose that the Paris green would be washed off with it more readily than if it was plastered on, as it would be more or less when applied with the lime instead of the Bordeaux mixture. The idea is to hold the poison there for a longer period, and in more effective form than you can when applied with the copper sulphate. There is no objection, when the trees are dormant, to applying the Paris green with the copper sulphate solution.

A Delegate: I would like to ask Prof. Craig a question. I am not well posted at all in the black knot and those other things in regard to the spores floating in the atmosphere from tree to tree. Do you not think, if we could have the Bordeaux mixture fastened upon the wood and branches early in the season, it would destroy those spores that float and lodge upon our trees before they could penetrate the wood and create what we call the black knot?

Prof. Craig: Some experiments have been carried on in preventing the black knot by spraying with Bordeaux mixture. At Ottawa we are surrounded by such remarkably favorable environments that black knot has not yet attacked us, though I found the other day a specimen, and I thought perhaps, with careful treatment, I might be able to produce some from this. (Laughter.) Prof. Lodeman, of the Cornell University, began some experiments for the prevention of black knot by spraying with the Bordeaux mixture, and they showed that there was reason to hope that we could successfully deter the growth and multiplication of the black knot by spraying. Of course he sprayed the tree at that period when the spores are being most actively disseminated; those periods being usually the months of June and March. He gave his trees several applications, but the

results were not so conclusive that he could say that it would pay, although he could say that it did prevent it. The question of pay could be successfully demonstrated only by experimenting on a larger scale.

Mr. McNeill: I have no hesitation in saying, after some years of experience, that spraying is an undoubted and positive cure to a very large extent—fully as large as has been testified to here—of these fungous and insect enemies.

Mr. Caston: The law which requires branches affected by black knot to be destroyed is, in many cases, a dead letter because not enforced, and unfortunately you will find a great many hedges that are literally breeding-grounds for black knot, the spores being carried in the wind. There will be no immunity as long as these hedges exist.

Mr. M. Pettit: Since the Act has been amended and made more workable it has been rigorously enforced for two years in our township. Black knot was spreading to an alarming extent, and now scarcely a vestige of it is to be seen. I believe it could be entirely wiped out.

Mr. Peart: We asked the township of Nelson to appoint an inspector, under the provisions of the Act, over a year ago. They appointed two inspectors, one for the northern half of the township, and another for the southern half. It has had a remarkably good effect. Wagon loads upon wagon loads of cherry trees affected with black knot have been cut down and burnt, and I think I may safely say that at least seventy-five per cent. of the black knot of the township has been wiped out.

Mr. M. Pettit: Simply cutting off the affected branches is not sufficient; letting them lie on the ground is just about as bad as letting them stand; they must be burnt.

Mr. Orr: Before the inspectors were appointed in our township, cherry trees were loaded with black knot, and every plum orchard, as far as I know, was seriously affected. I was going through my plum orchard, of fourteen hundred trees, the other day, and I found but one tree affected, and that is on the trunk, and we are treating it with coal oil to save the tree. We have succeeded in saving every tree.

Mr. Turner: I can speak for the St. Lawrence district, that a mere glance shows a difference in the foliage between the sprayed and unsprayed trees at the points visited by Mr. Pettit. The sprayed trees were interspersed throughout the orchard, just an odd tree here and there, which gave a very severe test. The results in the fruit were also very satisfactory indeed. I regret that Mr. Pettit did not speak in regard to the pruning and care of fruit trees which he had observed in his travels.

Mr. Rice: I once had a pear tree, one limb of which did not bear for several years, and one limb was bearing. In watching for the cause I found that a little grape-vine had got a tendril around that limb and cut into it and caused that limb to produce four or five pears—at least these were the only pears on the tree, and I judge that was the cause of it.

Mr. Wm. Gray, a veteran fruit grower in this locality, being called upon by the President, said: I am very much pleased to see the improvement that has been made in these gatherings. I remember that at the meeting of this Association in this hall some twelve years ago we had perhaps about two dozen. I think our Governments have acted very wisely in establishing these experimental farms; I think it is one of the most beneficial acts they have ever done. I think there is nothing that improves a country and people like horticulture and farming interests. I wish that every person in the province would take the *Canadian Horticulturist*; any one issue is worth to the people ten times the amount they pay for it. I have taken it from its first issue, and would always recommend it. It is required as much in the farm as in the garden.

The President: We have with us the Honorable the Minister of Agriculture, and as he is obliged to leave on the next train, and as we are anxious to hear something from him, I will now ask him to address you.

PRESENT DAY REQUIREMENTS OF OUR FRUIT TRADE.

Hon. Mr. DRYDEN said: I desire to congratulate the members of the Ontario Fruit Growers' Association on the energy they are displaying in the prosecution of the work for which this Association is organized. I shall not be speaking offensively of the past when I say that in my judgment you are renewing your youth, and now occupy a more prominent place in the minds of the people than at any time in your past history. I am very glad that such is the case, for at no time in the history of the province has there been so much need for activity along this line. The depressed condition of many departments of agriculture is forcing our people to consider what particular branch they may turn their attention to with any considerable profit. Just now there is no branch that is more attractive and presents greater possibilities than that of fruit growing. It has become clear that certain portions of this province are peculiarly fitted for the production of the finest fruit. Some localities are specially adapted for the production of plums; others, while not being equal in this direction, are found admirably adapted for the production of the finest apples. In some sections of the province the very finest quality of peaches can easily be produced, while in almost every section smaller fruits grow in great luxuriance. Some idea of the immense trade in fruit may be had from a glance at the photographs Prof. Craig has just shown me—one representing Winona station before the train arrives, and the other taken after the arrival of the train. Such a volume of business at one station indicates the enormous value of the whole industry throughout the province.

By those unfamiliar with fruit growing, who have in the past been engaged largely in other directions, and who desire to commence this industry, the very first thing needed is definite and reliable information. Naturally they look to an association of this kind, in whose ranks are found the oldest and most experienced fruit growers, to supply this need. May I remind you that it is in order that you may be conditioned to accomplish this that the Legislature gives you your annual grant. It is not merely that you may help each other, which is in itself commendable, but that through you the masses of our farmers may be educated along this line. Of late years my Department has multiplied the information annually given to the public in reference to various agricultural products, and we have also multiplied the constituency of readers who await the annual issue of each report. I am glad to tell you on this occasion that none of these reports are more eagerly sought for than that which comes through the efforts of this Association.

To make a success of any calling it is self-evident that knowledge of its requirements is the first requisite. No one would think of opening out a large mercantile establishment without some previous knowledge of the business. We do not allow a physician to practice unless by previous examination he furnishes a guarantee of proper equipment. No teacher can get a position in any of the schools of the country without such a preparation as is required by the Department. While this is acknowledged to be right, there have been in the past too many who believed that no previous knowledge was necessary in agricultural pursuits. By bitter experience many have discovered that the same principle holds here as in other callings; ignorance means certain failure, while knowledge leads to success. We provide free schools to fit professional men for their callings, the wisdom of which all classes acknowledge; and I affirm that one of the legitimate functions of the Government is to give to the people in addition the knowledge they require in order to fit them to do their best in agricultural pursuits.

Your business naturally divides itself into two parts—first, the knowledge necessary for the best production, and, second, that which is requisite to place the results of your labors on the market in the best possible condition. If we take the larger fruits—and I presume the same statement will hold good in reference to those that are smaller—the first thing concerning which the beginner will require information is as to the best varieties and those likely to be most successful in his particular locality. I am free to confess that this has been, and perhaps is now, a very difficult question to answer. I

have given some attention to the subject, and yet I have not definitely made up my mind as to what I should say to a beginner if he came to me seeking advice in this regard. There are some who would give him a name of a variety or varieties which they are willing to confess are somewhat inferior, but which they claim are at present in demand, because of its color or size. I have some doubts as to whether such advice ought to be accepted. The inferior apple will in the end be rejected by the market, no matter what its color; it needs only to be placed alongside of something that is superior, and the latter will inevitably take its place. Because such a variety at the present moment attracts attention on account of its exterior appearance is no rerson why ten years from now that variety will hold its place on the market. I take the same ground in the production of fruit as I do in the production of every other agricultural product, and I should like to say here that my belief is that more than ever the future will show that the article which has *intrinsic merit* will in the long run win. To advise a man to-day to plant a tree that produces finely colored fruit, but which is of itself of little value, is to lead him into a quagmire of disappointment.

When a beginner asks for information on this point there are several things that he must consider: First, will the variety, however valuable it may be, stand his climate; second, is it such a variety as is suitable for his soil; third, will it commence to bear during its early life, or must he wait ten or fifteen years before he can reap the fruit of his labors; fourth, is the variety a good bearing variety; and fifth, does it bear annually or only every other year. All these things ought to be taken into consideration in addition to the question as to whether the fruit contains in itself the points of excellence sought for in the best markets.

What I have said in reference to apples would, I presume, be equally true with reference to any other fruit. Now, it was in order to obviate this difficulty and to afford the information I have suggested, that my Department recommended to the Legislature the establishment of the fruit experiment stations that are now organized in different portions of the province. Some of us have found by bitter experience that the recommendation of a fruit grower in the Niagora district as to variety cannot be considered reliable when put into practice in some of the other districts of the province; the tree may be too tender, the soil may be unsuitable, etc. These experiment stations will give an opportunity to the beginner who desires information to go and examine for himself, and to ask the necessary questions of one who is authorized and conditioned to speak accurately in reference to the matter. Although we may not see the results of the establishment of these stations in the immediate future, those who live in the years beyond will find that this work will have borne abundant fruit to the advantage of fruit growers generally.

Having selected his variety, the next thing concerning which the beginner desires knowledge is as to proper cultivation. One difficulty I find in taking advantage of the knowledge that members of an association such as this have to offer is that they do not take into account that there are hundreds of people who are entirely without information as to how to proceed. So many things are taken for granted and not mentioned, but which should be if the beginner is to have the advantage of the experience of those who are older. It is quite possible for me to give you directions as to the erection of a silo and yet leave out two or three little items, which will probably not be noticed by the beginner, but which will lead to the entire failure of the whole concern. I am afraid that even the members of this Association do not fully understand the dense ignorance that prevails in many quarters in reference to the details connected with fruit culture. Information is needed how to plant, how to prune and how to cultivate generally. It is said that "eternal vigilance is the price of liberty," and with equal truth it may be declared that eternal vigilance is the price that must be paid for superior fruit.

One of the special things in cultivation which will demand the attention of all fruit growers in the future is that which has occupied a considerable portion of your time in the discussions that have taken place at this meeting; I refer to the necessity for spraying in order to produce the very best results. In mentioning this matter, I do not speak

of it in any guessing sort of way. I have arrived at that position when I am prepared to say that in some portions of the country those who refuse to attend to this matter will be unable to secure the best results. Men observe their trees looking unhealthy, they observe the leaves looking different to what they did in former years, but they never dream that this is owing to some disease they can correct by means of a spraying pump. This information must be given to the people, it means thousands of dollars of revenue to the country, because without it the fruit will be inferior and irregular and more or less unsalable; with it we shall be able to keep the trees healthy, the foliage full and clean and the fruit without spot or blemish.

We have done something in this direction already by sending through some of the counties a spraying outfit, showing how the work should be done. We have published bulletins giving full information as to the proper time for spraying and the ingredients of the various mixtures, but we have reached only a small percentage of the people interested. This work must be vigorously prosecuted in the future until all have had an opportunity to take advantage of our instruction. What, I ask, has placed our cheese ahead of all others? I answer, instruction of the people, and I assert that similar education will yet place our fruit in the same enviable place.

I am looking forward to the day when the fruit, especially of the Province of Ontario, will be sent to its best market in Great Britain in such a condition as to command the admiration of the Englishman; and when we have done that we shall have no difficulty in maintaining our hold upon the market. Depend upon it that in that market the best and best only will win the first place. It is largely with the Englishman a matter of confidence; once establish the fact that Canadian apples are the best, and that they are honestly placed upon the market, and they will command the price which their quality will warrant.

In educational matters we are wont to say to the young man just starting out: "Do your best and remember there is plenty of room at the top, while you will find the lower rounds of the ladder very much overcrowded." The same thing is true in reference to agricultural products: there is room in the best markets if we can attain the topmost round of the ladder. I have courage enough to say to this meeting now, that with the education we have given, and which we propose to give to the people in the future, we *shall attain this place.* (Applause.)

It will soon be manifest to everyone, whether he be educated or otherwise, that there is no money in producing fruit that can be stamped only as third class. The money has been made in the past, and will be made in the future, by those who pay such care and attention to cultivation as will enable them to produce the very best quality. This is the doctrine I am preaching everywhere, and I propose to continue to do so, for although other political nostrums are proposed labelled "N. P.," "P. I.," "P. P. A.," etc., each of which is to bring peace, joy and prosperity, wealth will only come by the improved production of such articles as the world needs. Lord Salisbury spoke truly when he said that "all England must depend on the energy of her people;" and if I should add anything to his statement it would be that Canada must depend on the energy of her people, intelligently directed by education.

But it is of no use our producing a good thing unless we are able to place it on the market where its excellence will be acknowledged. The proper marketing of our fruit demands several things; first, it must be placed in the best and most attractive package —in the sort of package demanded by the market where it is sent. I think we are extremely foolish in this country if we refuse to consider the tastes and requirements of the people to whom we are sending our fruit. If they say to us, "Your packages are too large and not of the right shape," we ought to accept their suggestion and try to meet their requirements. If they require a square package in preference to a round one, by all means let us provide a square package. Then we ought to remember that the man who is willing to pay the highest price must know that he is certain of receiving the quality of fruit that is equivalent to the money he is paying. My judgment is that

it never did pay, and that in the future more than in the past, it will not pay to send in these packages anything that is inferior. If culls are to be sold, let them be sold to our own people as culls, where comparatively no expense in the way of freight needs to be added to the great value of the article. But when we present our goods for the best customers let us see to it that it is honestly done, for in this as in other matters, Dr. Franklin's maxim will be found true that "Honesty is the best policy." On Monday of this week I received a letter from an old friend who is at present visiting in England. His former business having been that of a merchant he naturally takes a deep interest in the merchandise of his country as presented on the market in England. He says: "For over a month I have visited Smithfield market in Manchester, and to put it mildly, I am ashamed of the way Canadian apples are packed. With few exceptions one-fourth in each barrel are small, deformed and worm-eaten. The wholesale dealers assert that Canadian apples are liked best, and if purchasers could depend that the contents of each barrel would be similar in size and all of one kind, Canadians would hold the front rank in fruit."

Why should a Canadian visiting an English market thus have occasion to blush for the work of his own country? How long will it be before apple growers and apple packers learn the lesson that it is a suicidal policy thus to practice dishonesty. If I had my way, I do not hesitate to say that the man who thus undertakes to deceive our best customers and spoil our best market ought to be punished as his action deserves.

In addition to proper packing, proper transportation facilities must be provided, especially for the more tender fruits, if they are to reach the market at all. To send them there in a half destroyed state is worse than useless. I am glad to know that some effort has been made to undertake this work of cold storage shipments, but the effort so far has been an utter and entire failure. I have with me the report of the first shipment sent over under the cold storage system, and the statement of those to whom it was sent is that it would have gone much better if it had been sent in the ordinary way in the hold of the ship. This must be remedied, and I should like to see the fruit growers stand up and demand that some one be authorized to undertake the work who will see that it is properly performed." It is not enough for those in authority to say, "We have provided you with facilities. We must know that these facilities are of the very best. We have to compete with nations that are supplied with all the appliances of the very latest and best description. They are constantly making improvements in this regard. We cannot afford, if we would obtain what we ought to obtain in these markets, to send our fruit in any, but the very best condition. No government having the interests of the people at heart can long afford to disregard the claims of the fruit growers in this matter. There is every encouragement to afford assistance. We have proved our ability in this country to produce the very best fruit that can be placed upon any market. Our climate and our soil are such as in this regard will give us a decided advantage. Our people have the pluck and ambition necessary to make them excel. We will give them the knowledge requisite to the greatest skill; but all this is comparatively valueless unless those in authority are prepared, not in name but in reality, to assist in providing means of transport to the only certain market. What is being done for Australia must be done for Canada. It is not so much "fast service" that is needed as *safe service*. This Association ought to press its just claims. The Government which I represent here will always be prepared to render its best assistance to further improve products, but the matter of commerce must be dealt with elsewhere. I believe promises have already been given; it will be your duty to insist on their fulfilment. If these things are attended to, as I believe they will be, there is no fear that so far as fruit is concerned, Canada will hold a first place in the industrial race of the nations.

Mr. Boulter: While I differ politically from the Minister of Agriculture, I feel a great deal of pride as a member of this Association in having the privilege of listening to him, and I certainly have a great amount of pleasure in moving a vote of thanks to him for his very able address.

Secretary Woolverton seconded the motion, which was carried amid applause.

Hon. Mr. DRYDEN said all the thanks he required would be that the people would take heed to the thoughts he had suggested. With the Association at his back he proposed to continue on this line.

Mr. BOULTER, expressed his dissent from the report in one of the newspapers as to his remarks in the course of his paper read yesterday on British Columbia fruit, and asserted that he had never said British Columbia could not produce fruit; he had extolled certain kinds of fruit grown there, and said there were certain localities in British Columbia where they could grow good fruit; but there was not a man that tasted the British Columbia Northern Spy last night, that said it came up to the Ontario Spy.

Prof. SAUNDERS: During my ten years visits to British Columbia I have had opportunity of going over all their fruit sections and seeing their orchards and examining their fruits. I would not like to go as far as Mr. Boulter goes in regard to their quality; neither would I like to say British Columbia apples, all the way through, are equal to Ontario apples. I am sure that they are not in many sections, but I want to call your attention to the fact that there are two or three distinct climates in British Columbia. East of the Coast Mountain range we have a climate like that of England, with a heavy rainfall; that is about seventy miles from the ocean. This side of it you come to a climate practically rainless, where everything must be grown by irrigation. In that section the apples will probably be not quite so highly flavored as they would if grown in the ordinary way. The apples shown last night were from the dry section; they came from the orchard of Mr. Earl at Ashcroft, where they have no water to speak of. I was quite willing to admit that the flavor was not equal to the King as we have it here, for it is a little past its prime; but I have eaten good Kings at Agassiz, and the Government don't pamper their fruit trees any more than they pamper their officers—(laughter)—they give them good honest treatment, and that is all they can expect. Our orchard has not had any special fertilizing. The only good ground the people have for locating in Agassiz is that we have such a pure soil. At the same time we are producing some of the finest fruit that has ever been produced in British Columbia on that same soil, and we have now several hundred varieties of apples coming into fruit. Last year our Superintendent in an ordinary cellar kept some late-keeping varieties till spring; but we have not yet been able to pronounce definitely whether British Columbia is equal to Ontario in this particular, but from what I know and have seen of it I believe it can produce good winter fruit such as Spys and other late-keeping varieties that will command good prices in the world.

Mr. BOULTER: On the coast

Mr. SAUNDERS: On the coast, I mean; I have not seen enough of the interior. I would like to bring before the notice of the Association some remarkable variations which have occurred at Ottawa in the common Virginia Creeper. This as it grows naturally has to be tied and pegged against the walls of houses. It is a very desirable vine for covering trellises and verandahs. A "sport" has occurred at Ottawa which, I think, is the same as Nicholson, in his "Garden," calls the Hirsute form, or hairy form. The tendrils have formed sucker-like discs at the end, and hence in growing it sticks to walls or woodwork or anything of that kind just as firmly and freely and fully as the A. Veitchii does. Where the Veitchii can be grown this has no advantages, but where it cannot be grown on account of its tenderness (and that applies to the greater part of Canada) this variety, I believe, will grow—indeed, it will succeed—anywhere over Ontario, Quebec, or any part of the North-West Territories, because it is a native there; and I was going to suggest to the Association that, if they thought fit, it might be well to send out some rooted plants of this to members of the Association, and we would be very glad to propagate enough to distribute, so that it will be better known.

PACKING AND GRADING APPLES.

Mr. L. Woolverton, Secretary of the Association, read the following paper:

At the last meeting of our Association, at Orillia, the subject of packing and grading apples for the English market was discussed, but no very decided conclusions were reached. That some reform in fruit packing is needed is a settled question, as is proven by nearly every barrel of apples or basket of peaches purchased in our markets. The other day I ordered a basket of nice yellow peaches from the Hamilton fruit market, as mine had all been harvested and I wished a few for home use. When the top layer was removed the rest of the contents were white fleshed peaches and rotten at that. Who, that buys a barrel of apples in our city markets, expects to find the middle as good as the two top layers. I heard a packer once explaining that he was accustomed to put the poorer apples at the bottom, in order that they might bear the pressure of heading and thus save his finer specimens. "No, no," said the dealer who was shipping the apples, "do not put your poor apples at the bottom, put them in the middle, because the buyers open both ends of the barrel." Many times I have watched packers working under the directions of some of our large apple buyers packing apples in our orchards, and it is an open secret that the centre of the barrel is filled up with almost whatever comes. They say they have no time to carefully assort and grade the fruit. Well, if this is the case, then the apples that are thus packed should never be marked with XXX or "Extra Selected Canadian Apples." This kind of thing is bad enough in our own home markets, leading to want of confidence on the part of the public in purchasing fruit; but the damage to our country is a serious one, when it is practised in a wholesale way in connection with our export trade—a trade which is assuming immense importance. If, of the ten thousands of barrels that are being landed in Liverpool, London and Glasgow markets and are being constantly distributed throughout the United Kingdom, a large portion of them are packed in the way I have described, how can any honest, dealer who only ships a few hundred barrels in one season, ever hope to establish any reputation for his own fruit in face of so much badly packed Canadian fruit.

Even in spite of this terrible injustice which is being done to Canadian apple growers by apple dealers, Canadian Baldwins are kept away up in the English markets. For instance, under date of October 26, Messrs. Woodall & Co., of Liverpool, quote Canadian Baldwins at 16s. to 18s. 6d.; Boston Baldwins at 14s. to 16s. 3d.; Canadian Greenings, 15s. to 17s.; New York Greenings, 11s. to 13s.; Canadian Kings at 20s. to 25s.; New York Kings at 17s. to 21s; and this in spite of the fact that our apples go to Liverpool without being packed in any uniform grade, or marks which have any definite meaning. If, under such adverse conditions, our fruit has met with such a favorable reputation in the British markets, what might we expect if our apples were put up in uniform grades and were properly marked? I have received orders from Edinburgh for extra selected apples of assorted varieties at four dollars per barrel, f. o. b. at Grimsby, when at the same time the common price paid by apple dealers in the vicinity was only one dollar per barrel for the fruit. Surely there is room for a fine trade in Canadian apples if once we are able to assure the distant buyer of the quality indicated by a certain grade or brand marked upon the outside of the barrel.

I do not know that it makes very much difference what package is decided upon for the export trade. Whether anything better could be thought of than our customary apple barrel is a question. During the past season I have been making some experiments with an apple case which when full weighs between fifty and sixty pounds, according to the variety contained therein. This package I have lined with shelving paper, and all the fruit was wrapped with tissue paper, and nothing was allowed to go into these packages but a fancy grade of fruit. Some of us have combined in sending about one hundred cases to Sydney, N. S. W., to the care of Mr. J. S. Larke, the Dominion Commissioner there, who had written me that the market there is bare of apples during the months of October, November and December of each year. When the report of the result of this shipment comes to hand I will be glad to place before you all the information. I have myself sent 100 cases to our Provincial agent

in England, Mr. P. Byrne, of Liverpool, in order that I may compare the two markets for Canadian fruit. I have also forwarded a carload of barrels and cases to Edinburgh and one to Glasgow, and, on receiving the returns from each of these, I will be able to compare the advantages of these different packages, and these results I will also be glad to make public through *The Canadian Horticulturist.* Uniformity in the size of our packages is certainly of importance. Some of our apple growers use the flour barrel, of which the length of stave is about thirty inches; others use the legal apple barrel of Canada, of which, I am informed, the length of stave is twenty eight inches, or about twenty-seven inches from croe to croe. However, the difference in the two barrels is easily detected when they are standing side by side, and the fault here is in giving excessive measure, and not in cheating the buyer. In the smaller packages uniformity is sadly needed. At a meeting of fruit growers called at Grimsby during the summer this question was considered, and it was decided to ask the Ontario Legislature to regulate fruit packages according to the following scheme, it being understood that these sizes do not apply to fancy baskets in crates, but only to ordinary fruit baskets. The names given them are only to distinguish them; the sizes are supposed to be the same for each number, no matter what fruit is put in them. Taking wheat of standard weight as a medium to determine the capacity of packages, the sizes of fruit baskets were recommended as follows:

	Pounds.	Ounces.
No. 1—Pint berry box, should contain of wheat	..	12½
" 2—Quart berry box " " "	1	9
" 3—Half peach basket " "	11	4
" 4—10-pound grape basket " "	13	14
" 5—12-quart peach basket " "	22	8
" 6—16-quart grape basket, or 20-lb grape basket, should contain of wheat	30	..

I mention this here, in order that it may be discussed at this meeting.

But, to return to the important subject of grading, I believe that, even in our own markets, contracts could be made with much greater facility if we had some regularly established and well-known grades. I am sure that I may take it to be an established point with the members of this Association here present that the grading of our apples, at least for export, is desirable. The next point to be considered is, are the grades proposed satisfactory?

The following is a definition of the grades as found in the Dominion Inspection Act and also as proposed in the first draft of Mr. Dryden's Bill for the prevention of fraud in the sale of fruit:

Grade "No. 1" shall consist of well grown specimens of one variety, as nearly uniform as possible in size, and throughout of good form and color, sound and whole, and free from worms, bruises or disease.

Grade "No. 2" shall consist of well grown specimens of one variety, sound and whole, and throughout reasonably free from the defects mentioned in the preceding paragraph, but which, on account of inequality of size, lack of color or other defects, could not be included in grade "No. 1."

Of course the packer may have both his extra and his fancy grades, which will be private, and which he may use at his discretion, but these are only sub-divisions of grade No. 1.

Possibly some shippers will object to the terms "grade No. 1" and "grade No. 2." When the Bill was up before the House last spring some shippers said, "No, it will never do to put No. 2 on our apple barrels. Nobody will buy them if we do." Well possibly the term "No. 2" is too strong, being so often applied to culls which are only fit for cider. If that objection is offered by many packers, I would propose that we simply say "grade A" and "grade B," instead of "grade 1" and "grade 2." However, for myself I am satisfied to use the terms already proposed.

The next question before us is: Shall the marking of the grades on packages of apples and other fruits be made compulsory? This is an important subject. The Bill presented to the House last spring met with the stiffest opposition from apple buyers,

because it read "For the purpose of this Act, the fruit *shall be* graded as follows." They do not wish to be compelled to mark the grades. They feel that the next step would be inspection and that careless packing might be mistaken for fraudulent packing. Well, perhaps it was too sweeping to compel every packer and shipper to mark the grade upon every barrel. Uniform ideas with regard to grading do not prevail, and every packer might not be posted with regard to the definitions of the various grades, or a shipper might buy a car of apples on speculation and afterwards himself become responsible for the grading which had been done by some one else, and thus he might become unfairly subject to a fine. Perhaps, therefore, it would be better not to make the grading compulsory, but by all means let us have a Bill that clearly defines what is meant by "grade No. 1" and "grade No. 2" when these terms are used and that makes it a fraud to brand a barrel as No. 1, which contains No. 2 apples. Buyers will in time demand that there be a uniformity respecting the grade of all the apples which they are purchasing, and further, the fact that such grades have been defined by an Act of Parliament and agreed to by our Canadian growers, will go a long way towards increasing the confidence of the buyer in making his purchase.

Then if a buyer in Ottawa or in Liverpool buys a carload of apples marked "grade No. 1," and they prove not to be up to the legal definition of that grade as laid down in the Act, the buyer will not be obliged to pay the sum agreed upon. These conditions will increase the trade in apples, the very thing that we fruit growers of Ontario desire to encourage.

The next point is: Shall there be a Provincial inspector, whose business would be to seize or confiscate any fruit offered for sale which he might discover to be fraudulently packed? I am inclined to think that this also would be a step in the right direction, and the fact that graded fruit was subject to inspection would tend to produce a wholesome fear of fraudulent packing on the part of all packers. But as fruit growers are the only class of men who never cheat, I need say no more under this head.

Let us now read very carefully and consider the proposed Bill for the prevention of fraud in the sale of fruit, from which those sections which refer to the grading of fruits were expunged before it was passed. I am inclined to think that with one or two verbal changes these clauses might be preserved and render the bill much more effective:

Proposed Bill.

AN ACT FOR THE PREVENTION OF FRAUD IN THE SALE OF FRUIT.

1. In sections 2 to 6 inclusive of this Act unless a contrary intention appears:

(1) The word "fruit" shall mean and include apples and pears.

(2) The word "packing" or "packed" shall mean and include the placing of fruit in any box, crate, barrel, basket or other article and the covering and securing of the same with slats or bars or with a lid or cover of any material whatever.

2. Every person packing fruit for sale in bulk *shall* mark upon the outside of the box, crate, barrel, basket, or other article in which the fruit is packed, in plain and legible words to be branded or written in a durable manner in or upon the material of which the article is composed:

(*a*) The words "No. 1" or "No. 2," according to the grade of the fruit, or the word "ungraded," as the case may be, and

(*b*) Except in the case of ungraded fruit, the name and post office address including the name of the Province, of the packer,

(*c*) The name of the variety so packed.

3. For the purposes of this Act *fruit shall be graded* as follows:

(*a*) Grade "No. 1" shall consist of well grown specimens of one variety, as nearly as possible uniform in size, and throughout of good form and color, sound and whole, and free from worms, bruises or disease.

(*b*) Grade "No. 2" shall consist of well grown specimens of one variety, sound and whole, and throughout reasonably free from the defects mentioned in the preceding paragraph, but which on account of inequality of size, lack of color or other defects, could not be included in grade "No. 1."

4. All fruit not coming within the classes mentioned in section 3 of this Act, and which is packed and offered for sale in bulk, shall be classed as "ungraded."

5. Every person who after packing fruit or causing it to be packed, shall sell such fruit or offer the same for sale or otherwise dispose of the same without having made the marks required by section 2 of this Act, or any of them, shall be liable on summary conviction therefor to a penalty of not less than $1 nor more than $5 and costs.

6. Every person who with intent to defraud:

(*a*) Alters, effaces, obliterates, or covers wholly or partially, or causes to be altered, effaced, obliterated or covered, any packer's marks made on any article required to be marked under the provisions of this Act, or

(*b*) Counterfeits any such marks or brands or writes the same on any such article, after the same has been once marked, or

(*c*) Empties or partially empties any such marked article, in order to put into the same any other fruit (of the same or any other kind) not contained therein at the time of the original marking, or

(*d*) Uses for the purposes of packing fruit, any article bearing marks previously made by any other packer, or

(*e*) In making or purporting to make any of the marks required by this Act, falsely states the grade of fruit packed in the article marked or the name or address of the packer or the weight or measure of the fruit so packed,

Shall be liable on summary conviction therefor to a fine of not less than $1 nor more than $5 and costs.

7. Every person who shall knowingly and with intent to defraud so place or arrange apples, pears, plums, peaches, nectarines, cherries, grapes, apricots or berries of any description whatever, whether graded or ungraded, in any box, crate, barrel, basket, or other article, for delivery to any other person in such a manner as to conceal defects in size or quality in any portion of such fruit by covering the same with fruit of larger size or better quality or otherwise shall be liable on summary conviction therefor to a penalty of not less than $1 nor more than $5 and costs.

8. Every person receiving fruit of any kind mentioned in the preceding section for sale in bulk on commission, shall, within one week after any sale by him of such fruit or any part thereof, mail to the address of the consignor of such fruit a written notice of the price or prices received therefor and the name and address of the purchaser, and any person failing to send such notice or to give the particulars therein, required by this section, shall be liable, on summary conviction therefor, to a penalty of not less than $1 or more than $5 and costs.

9. No prosecution or conviction under this Act shall be a bar to any proceeding for the recovery of penalties which may be imposed under any other Act, nor to any action for the recovery of damages which may be brought by any person injured or defrauded by the sale of fruit in violation of the provisions of this Act, but all such penalties may be recovered, and all such actions may be brought in the same manner as if this Act had not been passed.

The changes which I would propose are as follows:

In section 2, instead of "every person packing fruit for sale *shall* mark on the outside, etc., I would substitute the words "may mark."

Then in section 3, for the words "fruit shall be graded," I would substitute the words "the grading of apples and other large fruits shall be defined."

Section 5 I would omit entirely.

The following is a copy of the Bill as passed by the Legislature:

AN ACT FOR THE PREVENTION OF FRAUD IN THE SALE OF FRUIT.

Vict. 58, Chap. 48.

1. Every person who with intent to defraud:

(*a*) Alters, effaces, obliterates, or covers wholly or partially, or causes to be altered, effaced, obliterated or covered, any packer's marks made on any article in which any fruit is offered for sale, or

(*b*) Counterfeits any such marks or brands or writes the same on any such article, after the same has been once marked, or

(*c*) Empties or partially empties any such marked article, in order to put into the same any other fruit (of the same or any other kind) not contained therein at the time of the original marking, or

(*d*) Uses for the purposes of packing fruit, any article bearing marks previously made by any other packer, or

(*e*) Falsely states the grade of fruit packed in the article marked or the name or address of the packer or the weight or measure of the fruit so packed

Shall be liable on summary conviction therefor to a fine of not less than $1 or more than $5 and costs.

2. Every person who shall knowingly and with intent to defraud so place or arrange apples, pears, plums, peaches, nectarines, cherries, grapes, apricots or berries of any description whatever, in any box, crate, barrel, basket or other article, for delivery to any other person in such a manner as to conceal defects in size or quality in any portion of such fruit by covering the same with fruit of larger size or better quality or otherwise shall be liable on summary conviction therefor to a penalty of not less than $1 nor more than $5 and costs.

3. Every person receiving fruit of any kind mentioned in the preceding section for sale in bulk on commission, shall, when requested to do so by the consignor in writing, furnish the said consignor, within one week after receiving notice or after disposing of the fruit as may be requested, with a written detailed statement in regard to the sale or disposal of the same, giving the price or prices received therefor and the names and addresses of the purchasers.

4. No prosecution or conviction under this Act shall be a bar to any proceeding for the recovery of penalties which may be imposed under any other Act, nor to any action for the recovery of damages which may be brought by any person injured or defrauded by the sale of fruit in violation of the provisions of this Act, but all such penalties may be recovered, and all such actions may be brought in the same manner as if this Act had not been passed.

EXPORT TRADE IN APPLES AND OTHER FRUITS.

Prof. Craig, said: I wish to make an explanation to the fruit growers of Ontario with regard to the trial shipment referred to at this Convention at different times. There is no need for me to dilate on the fruit interests of this country. That has been frequently given to you at different times already. I had intended running over rather briefly the resources of the different provinces, because I wanted to speak to you from the Dominion standpoint, as I am a Dominion officer and have the interests of the other provinces at heart as well as Ontario, but time will not permit at present. I want to come to that part of the subject which takes up the question of how we might get rid of our surplus products largely of a perishable character, and that brings us to a period of the year between the middle of August and the first of November. At that time we have a quantity of fruit of a perishable character in the country much in excess of the demands of our home market. Last year at the request of the fruit growers, on account of pressure brought from various points, we decided to make a trial shipment. Mr. Dryden referred to that this afternoon, and I am sorry he is not here just now to hear what I have to say on the matter, because if there was any failure—and there was a big failure—there is no one perhaps more to blame than I am myself, and I am here to take the responsibility of that failure. Mr. Saunders in his remarks last night I thought, rather put the onus on the fruit growers. Well, it does not rest there, and a body of men who are not to blame should not receive it. I want at the present time to make an explanation. The Fruit Growers' Association waited upon the Minister of Agriculture at Ottawa and asked him for some help towards getting fruit of this perishable class to England. There was no appropriation at that time to be specially devoted to this work, but he stated his desire and willingness to give them such accommodation as had been already prepared by a special vote of money for the exportation of butter; and I went to some of the pear growing districts and waited on some of the fruit growers, and we immediately decided that it was well to take advantage of the Government's offer at that time, and so we just interposed one shipment of fruit instead of a single shipment of butter. Now, that was an experiment. Mr. Dryden said that those who had charge of it should know. Without doing how could we know? We had had no experience in the line of shipping fruit, and I may say we made a mistake in making such a large experiment, but we had not the knowledge before us whether that fruit was going to get over there in good condition. We might reason from similar cases, and possibly might have reasoned more correctly, but we had not the knowledge before us, and we did the best we could under the circumstances and the fruit growers gave us the fruit and put it up in packages which we mutually decided were best and we shipped by Montreal. I do not want to lay any particular blame on the transportation company, but I will say that I asked them specially to see that that car was specially watched en route and that ice was put in whenever it was needed. However, it arrived there without ice, and the fruit in a very warm condition. There are two conditions to be kept in mind in sending fruit in this way. If we have a temperature of forty to fifty degrees we should have ventilation. If we have a temperature of thirty-two to thirty-four degrees we could ship without ventilation and in tight packages. In the case of low temperature no change takes place in the chemical make-up of the fruit, and no heat is generated; in the other cases a

slight change takes place and heat is generated. We had those close packages and had no ventilation. We had to keep the temperature sufficiently low that there would be no need of ventilation. That hope failed. I helped to put ice in the car at Montreal, and it was loaded at night and under the best possible conditions; but there was a sufficient amount of heat in the boxes to melt the ice that was in the compartment to keep it cool, so that by the time it arrived in England the ice had all disappeared and the fruit had generated a considerable amount of heat—so much so that it caused a great deal of decay and was a failure. But we are not going to stop there, and as the onus of the failure rests upon the officials of the Dominion Government I am pleased to say that the Government has now under consideration a scheme for the carrying out of this work next year to what I hope will be a successful issue. The outline of the plan has not been fully sketched yet, but I trust that it will be something like this—that eight or ten trial shipments—not necessarily large, because our experience of the past will show that we can get information with small quantities just as well as with large—will be made covering the perishable fruits of the different provinces; that these shipments will begin about the middle of August and be carried on as long as we see that we are deriving information of a valuable character to growers. That plan I think can be worked very well with the dead meat scheme which Professor Robertson outlined at Guelph the other day and which is also under consideration by the Government, and I have every faith that we can put our perishable products on the English markets in a good selling condition and that they will be of sufficient quality to attract the attention of buyers over there. I do not want to say a word against the commission men on that side, but I know they are a difficult lot of men to move out of certain channels, and it is difficult to get them to adopt new ideas, and I do not know that we can through them arrive at the best results on this matter, but we shall do our very best to bring this work to a successful completion and use our very best judgment; and I would ask the co operation of the fruit growers in regard to suggestions, and anything else that may be given along that line to the officials who are likely to have this matter in charge. (Applause.)

Mr. A. H. Pettit: I also regret Mr. Dryden's absence from the room just now, because I want to reply to one or two remarks he made to-day in regard to the shipment of our fruit to foreign countries. In my estimation we are to-day in a rut, and we have to get out of that rut. Why is it that the fruit growers of this country most capable of putting their fruit up in proper shape and forwarding it to the British market are not doing so? Well, I will tell you why I am not doing that, as one. For fifteen years I have exported to foreign countries more or less apples each year, and I have come to the conclusion that the system of handling fruits in England is not a system that is in the interest of fruit growers of this country. We have also had a little experience in our own cities and towns during the last four or five years in handling fruit in that manner. They have been trying it in Montreal and Toronto—that is the auction business. Do you think for one moment that the fruit growers of this country can put up their apples, ship them to London and those points and have them auctioned at a common sale? I would ask Mr. Karn, who is in the room, would that be the way that he would expect to receive returns for his pianos and organs were he to ship them to those cities and have them put up at auction? We must get out of that rut and educate our men to put up fruits for fancy markets and then sell to the consumer of fruit in the best possible condition without the expense of the middleman if possible. Until we can arrive at that point I do not think we can win the confidence of the fruit growers of this country to put up their apples and ship them to that market. Now, how are they shipped there to-day? I have been both buyer and shipper, and I know. To-day the condition is this, that if I buy ten or fifteen thousand barrels we begin taking our apples throughout our section from the 10th to the 14th of October. Now how long have you got to do this picking and packing? (A voice: "About two weeks.") They employ a number of people to pick their apples and pack them, and pay them so much a barrel to put them up. They want to put up as many as they can; it is natural that they want to make as much money as they can—that is all they are working for. Now I claim as a rule they cannot get experienced men to pack those apples as they should be packed in that space of time,

and not being packed in proper condition they are sold in the Old Country to the discredit of many growers who are not to blame in this matter. I say there is no man more capable of packing apples for the British market than the grower himself; and we must get out of that rut so that we can ship them to the market up to a certain brand. A gentleman says: "Why don't you work up a brand of your own for the British market?" I did that once. My apples brought me a good price and got me a great deal of credit for arriving in good condition. What was the experience next year? London got crowded with apples and the commission men, who had branches in London, Glasgow and Liverpool, advised that I had better ship to Glasgow. I got a great deal of credit again; they arrived in fine condition. The advice next year was to ship to Liverpool; the next year the advice was to ship to Chicago, and they went there. My life is not long enough to establish a character in that way, and if I have to ship to different points each year I will never reach the goal I aimed at in the beginning. Let us get out of the rut, if it is possible to do so. The Old Country people are very staid in their ways; everything has to be done through a certain channel; but I believe if we as fruit growers were united in this matter and asked Prof. Craig and the Government, in connection with those fruit experiments they are going to try, that they would also go on to that country and establish a trade for us in some limited way, we in time would get out of that rut and be dealing with the consumers of that country, to the advantage of the fruit growers of Canada.

Mr. Boulter: Do you recommend that each grower pack his own apples and ship them to England?

Mr. Pettit: I say when you get out of the rut in the Old Country that you are in now and have your goods handled as they ought to be, directly by the consumer, then I say let the fruit growers pack the fruit themselves and sell them to the best advantage, and in my opinion they will get double the money they are getting now.

Mr. Boulter: If I had a thousand barrels of apples and was selling them I never would pack one of them. I would rather the man who bought those apples would oversee the packing of them, and send his men. I would pick them and put them there and let them pack them, because if you pack them and the price of apples dropped, no matter how much, there would be some rebate required on them, and you would have trouble before you got through with that buyer. The experience of the growers in Prince Edward county, who have had thirty or forty years' experience, is that it is better for them to sell their apples either by the orchard or by the barrel and let the buyer send on his men. They are not employed by the barrel, but they hire these men by the day and they put up their apples, and the result is that when the farmer's apples are drawn to the car he gets his money and his responsibility ceases, no matter what the fluctuation of the market. As a large buyer of peaches in the Toronto market, I say it is scandalous the way the fruit is put up. I had a wholesale man in Quebec last August say that his experience in 1894 was that he never got a decent peach from the city of Toronto—worthless things in the bottom and middle and good peaches on the top. Now there is a great deal to be learned in packing. I believe Mr. Woolverton has endeavored as far as in his power to improve the system of our growers in putting up a better class of fruit and using boxes. As regards grading: If No. 1 and No 2 are objectionable as names why not have the words "Standard" and "Extra Standard;" but I do hope that some system of grading fruit will be recommended by this Association to the Government and carried out.

Mr. Pettit: As regards Mr. Boulter's remarks about last year's peaches, I am only surprised that he got a few good ones on top, for I don't think there were any good peaches in the peach-growing section last year—they were the poorest that were ever grown in that section. I believe the fruit growers of this country can pack their fruit just as nicely and well as any other class of people on the face of the earth. (A voice: "Of course they can;"—hear, hear.) I say they want education along the line of the best method of packing for foreign markets. There is our weak point, and when we get out of that rut in regard to shipping to the British market we will

get a healthy business along that line. I beg to move our appreciation of the action of the Government in proposing to take along that line by the trial shipments, and that we as fruit growers hope that they will carry it to a successful issue in the interests of the fruit growers of Canada.

Mr. BOULTER seconded the motion.

Mr. CASTON: The short time between the picking and the shipping of the apples does not make it practical to pack them properly for the Old Country. In Meaford and Thornbury they have frost-proof storehouses—paying so much a barrel in the orchard and taking everything except the culls, and putting them all in the barrel quickly, pressing them sufficiently to keep them from bruising until they reach the storehouse. We always give instructions to packers to pick them carefully. Sometimes with some hard apples it is impossible to detect a poor one, and pickers will shake them off the trees in a hurry. If they stay in barrels any time and are repacked we can detect them. McWilliam & Everist, who handle about fifty thousand barrels a year, are doing the same thing—having them repacked for the English market, with the exception of fancy packing in cases. Repacking is the most practical way of doing it for the Old Country.

Mr. MCNEILL: We should decidedly thank the Government, and particularly Prof. Craig, and not the slightest blame should be attached to him, for he had not the facilities at hand which were needed for successful cold storage. It is one of those mistakes that anyone is liable to make, and one scarcely anybody can foresee. I think Prof. Craig is saying too much when he says he is to blame for this thing, and I think we should thank him for the efforts he has made in this direction.

Mr. A. H. PETTIT: We all know we can make a small shipment of these perishable fruits to England without the least trouble; but what we want to provide for is the large shipment, the commercial shipment, such as you and I would want to make if we were shipping a carload; because if you put a carload together in the hot season of the year it would itself create heat.

Mr. SHUTTLEWORTH (Bow Park): Denmark is producing fine apples; France is producing good apples, and they are putting up all kinds of fruit in just as good condition as we are, and yet they are nearer the market. I don't think we will be able to export the kind of grapes grown here at the present time. England is getting grapes from Lisbon, very much superior to anything we have here, and which suit the English taste; they are accustomed to eat a fancy grape, one they can bite. Englishmen don't swallow the seed; they usually bite the grape; they have been accustomed to eat what they call the highest class of grape. The Lisbon grape is better in that way, as they don't give a sour taste in the mouth, while our grapes give a sour taste. In France and Jersey Island they have very fine fruit, and these are very near the English market. When I opened up fruit that was branded as No. 1, I have been almost ashamed I was a Canadian; that will confirm what the gentleman wrote to Mr. Dryden. You may call your grapes No. 1 or No. 2—an Englishman don't care what you call them as long as you give him what he pays for. I don't think that anyone who understands the condition of the market will object to having fruit graded No. 1 and No. 2. Only those who have a desire to get No. 1 prices for No. 2 fruit would object, and these we want to get rid of, whether growers or exporters. Our firm handles about a third of the total exports of American apples to Europe; that is, we handle from three to five hundred thousand barrels a year, and I have watched very closely this matter of classification and grading, and a great many of our apples classed as No. 1 are not No. 1. I wish we could have a law that the packer of apples not No. 1 who brands them as No. 1 should be fined and punished, because it is a fraud, the same as shipping a filled cheese. In trying this experiment I think the Government should really understand the conditions that exist in the English markets and what they have to compete with before they disappoint shippers. Tomatoes from France and Jersey Island and Spain, come over to England, costing for freight about one and sixpence, a large case holds what may be considered a barrel; they come in packed in boxes about 175 or 180 pounds in a box.

The PRESIDENT: This is a very interesting question, and we invite apple buyers and shippers to join in the discussion.

Mr. SHUTTLEWORTH: I am not only a shipper; I am a grower. I claim I am a Canadian grower now, I am Canadian born, though I have been living in England so long, and I would like to give my views more definitely on the point, in a uniform manner, that is dealing with each question. I would be glad to answer any questions. I would like to see our Canadian trade increased.

On motion of the SECRETARY it was decided to resume the discussion to-morrow morning after the election of officers, and the meeting adjourned at 6.15 p.m.

SECOND DAY—EVENING SESSION.

The session was held in the town hall, the audience being larger than during the day.

President PETTIT read his annual address, which appears at the beginning of this report.

THE IMPROVEMENT OF THE GLADIOLUS.

Mr. H. H. GROFF, of Simcoe, read the following paper:

In an article published during the present year, by one of the leading horticultural journals of America, the statement was made that "there had been no improvement in the Gladiolus during the past ten years." It will be of interest to consider the general condition of this popular flower at that time, after it had been before the public for some forty years, and since then, during which all the new strains have been introduced. But before going more fully into the question, I beg to advance the claim that there has been more improvement during the past five years, than during the whole preceding period of its history.

The Gladiolus of ten years ago descended from a cross between two Cape species, and is known as the hybrids of Gandavensis, the section in general cultivation. For many years the varieties originating from this cross have been inbred without careful selection, which has resulted in one of the most variable plants known to the hybridizer; in fact this condition is made ground for the claim, that there is no advantage to be gained by hand pollenizing, as the leading varieties of commerce are the outcome of natural fertilization.

The extent to which this indiscriminate seed raising has been conducted, may be better understood when it is known that commercial seedlings are often grown from seed than can be bought for a few shillings per pound. Such seed can hardly be produced from valuable varieties, for the process of said raising is most exhaustive to plant life, and so apparent is its effect on the degenerated vitality of the hybrids of Gandavensis, that if they survive the effort, it cannot generally be repeated without an intervening season of rest.

Now to admit this sweeping assertion, is to concede that the work done during a comparatively recent period, the first results of which were introduced about five years ago, has indicated no advance on the line of improvement, and that the time of Kelway, Souchet, Lemoine and others has been wasted, in their efforts to increase the beauty and strength of the subject of this paper.

It will here be in order to consider the meaning of the term improvement as applied to the Gladiolus; and I take the practical and popular ground that it should mean; first, the beauty of the individual flower; second, strength and vitality of the plant; and third, arrangement. During the past season, many visitors to my trial

grounds containing some 1,000 named varieties, would stop before a hybrid of distinct merit; the plant and straight spike stood six feet high, bearing a few open flowers rivalling the orchid in its richness and beauty; and without exception it was pronounced the gem of the collection, thus proving the first principles of improvement.

We often hear objections made to a variety or strain, condemning it for lack of substance. Now, while Camellia like petals are most desirable and too rarely obtainable, their absence cannot be made a point for rejection, unless at the sacrifice of some of our most beautiful varieties. Substance is largely a question of weather; for if after a period of cool moist conditions, a few hours of intense heat prevail, very common occurrences in our variable climate, large flowers must wilt, and the larger they are the worse they are affected. The remedy, however, is easy and most satisfactory, cut the spike when the first flower opens, blooming in the house, where the last bud of any size will do even better than in the open ground. This treatment also strengthens the bulb.

The first of the crosses between the hybrids of Gandavensis species is popularly known as the Lemoine section, the varieties of which in general cultivation partake largely of the characteristics of the species, their peculiarity being rather weak plants with crooked stems bearing small bell-shaped flowers. From these conditions the past five years have seen developed one of the most beautiful and popular Gladioli in existence, a plant of great vigor, straight spikes, and flowers of the largest size.

Among the newer hybrids and the best finished of the crosses with the species Saundersonii, is the Nanceianus section introduced in 1890. While the general coloring of this strain is in shades of red, partaking as it does so largely of the blood of the species, the wide open flowers are of enormous size, and great richness and brilliancy of coloring. The plants of the newer varieties are robust, the flowers of good substance, and bulbs of great vitality. To say that this is no improvement is to ignore a class, the influence of which will be seen in choice work yet to be introduced.

That section of European origin offered under the name of Childsi in 1893, is the latest of the Saundersonii crosses in order of introduction; it is the result of crossing the hybrids of Gandavensis on the species. The plant is of robust habit, with flowers of the largest size. While lacking the finish and coloring of the Nanceianus section, it contains the first break from red shades among the Saundersonii hybrids as known to the amateur.

It has been my privilege to test many varieties in advance of their dissemination, among which are the new hybrids originated by Mr. F. E. Gray, of Alhambra, California. When these are introduced, the value of the infusion of new blood of the species will be more fully appreciated. With me these plants bearing spikes over two feet in length, attained a height of fully six feet, with flowers of the Gandavensis form four inches and more in diameter.

Without reference to any strains yet to be introduced, it is with every confidence that I rest my contention on the evidence preceding, that the Gladiolus has improved, and will continue to do so for many years to come.

Mr. W. E. Saunders: I would like to ask if Mr. Groff has obtained any very different results by planting bulbs at different depths in the earth; also, I would like to know the parentage of Nanceianus on both sides.

Mr. Groff: My reason for not giving details in connection with any of the various sections was that they were fairly well known. The parentage is a cross between the Lemoine and a species of Sandersonii. My rule is to plant six inches for large bulbs. My reason for that is that the new corm forms above the old one, reducing the depth to five, whereas if you plant only four inches, as often recommended, it reduces it to three. However, if your soil is shallow it would be much better to plant nearer the surface and ridge it than plant so that the new roots will find no nourishment in the barren subsoil. My own soils of course have that peculiarity.

Mr. Mitchell: It has been my practice about blooming time, or a little before, to earth the stems, and I find it did them no damage, and helped to keep them from falling over.

Mr. GROFF: I have not tried that. I am always working between the rows, and I like to have a footing as level as possible. I always plant a depth of six inches; but I recommend that as an alternative where shallow planting is practical, if it is necessary.

The SECRETARY: Which bulbs are best for amateurs to plant?

Mr. GROFF: Canadian grown bulbs. You may think that this is talking shop, but there is a great deal in having your stock acclimatized. Last year I imported some three hundred varieties from one of the leading firms in Holland, and from the whole lot I did not get thirty spikes of bloom, and of them about fifty per cent. died, as a result of the change I suppose.

Mr. G. R. PATTULLO: Has your success been such as to give you a market elsewhere?

Mr. GROFF: Yes; but I have not been long enough engaged in the work of reaching into foreign markets; still for 1896 the leading firms of America are listing my hybridized seeds as a novelty, each one bearing my name and address. If not out of order, I would like to say a few words as to my own work. While in a general way it is for the improvement of all the sections, specially it is with the idea of producing new colors and shades practically unknown to the amateur, my lines of operation having been approved of by no less an authority than M. Lemoine. With this view I am constantly corresponding with specialists in Europe and America, securing their most choice work often in advance of its commercial dissemination, for the purpose of crossing with varieties of a suitable character in my own collection. One sends me a seedling, the most beautiful he ever saw, after importing freely the cream of the latest foreign work. Another seedling, the best of its type, would neither increase nor produce seed with its originator, but did both with me, showing the benefit of climatic change One variety of rare merit secured in this way was pronounced by an expert to be worth its weight in gold. It will therefore be understood that the chief object of my work is the production of new varieties by hand-pollenized seed, my experience with which has been that fully seventy-five per cent. of the varieties thus produced are worth retaining. After some years of selection and increase of distinct varieties of merit, for the coming year's work I have added all of the latest introductions of Souchet, Lemoine and others, including the whole stock of Mr. Burbank's new California strain, described by him as "the cream of all he ever produced, his last and best selection." In adding the above to my already choice stock, the result of former work justifies me in the conclusion that seed and seedlings produced from the crossing of these strains must be the greatest advance in commerce. This claim is already supported by the fact that the leading firms of America are willing to list my seed as a novelty, to be furnished in the original packets, eacn bearing my name and address.

Mr. RICE: Do you plant them out first?

Mr. GROFF: Plant them out first. Of course they can be forced under glass, but there is nothing to be gained by it as affecting the quality of the flower—in fact the contrary. I might say that if you wish to start them you should always use bulblet-growing bulbs, not use old bulbs.

Mr. LOUGHEAD: Do you consider using large bulbs that they are apt to degenerate? Do you encourage growing from spawn and bulblets in order to keep up the quality of the stock?

Mr. GROFF: It is the general experience of growers that varieties of the Gandevensis degenerate, and that has been my own experience, inasmuch as it is the custom of European introducers to send us high-priced bulbs running from one to three dollars each from which seed has been raised, and if these produce the characteristic of the flower it is the exception, and they often die before they recover sufficient strength after enduring the climatic changes to really let you see what they should be; and it has always been my rule to endeavor to procure grown bulbs from these. You can get the characteristic of the flower from the old bulb, as a rule, the first season if you are able to carry it over, but it has been invariably declined; they simply won't furnish them.

Mr. McNeill: What diseases are the bulbs subject to? I found that when I transferred my collection to stiff clay I lost them all with a fungus disease that left the bulb in cup-like shapes with a resinous margin.

Mr. Groff: On my own ground, although it is very small, where I have four varieties of soil, when I plant in stiff clay I open out a trench, putting in my bulbs and fill it up with loam; and stiff clay is the one soil that is objected to for the growing of the bulb. The disease I presume will be attributed to the condition of the soil on which it is grown.

Mr. McNeill: You have never observed that disease?

Mr. Groff: Mine have always been healthy.

Prof. Craig: Please repeat your instructions about cutting off the flowers in hot weather.

Mr. Groff: I think this bulb should be grown very extensively in every garden for cut flowers. When the first bud opens, cut off simply a spike, not too low or you would injure the bulb in its development. They will bloom set in water in the house. In the large cities where light colors are used for general purposes, funeral decorations and others, they bloom them in the cellar to eradicate any colored stains that might be developed by the light.

Prof. Craig: What time do you cut them?

Mr. Groff: Just as the first flower opens.

A Delegate: Planting the same bulb year after year, does it degenerate?

Mr. Groff: In the Gandevensis that is the case. At the same time an infusion of the blood of the species has increased their vitality to such an extent that you can plant them indefinitely.

A Delegate: How would you replace—get new ones?

Mr. Groff: Yes, unless you get old bulbs a second time. Dealers like to send out the old bulbs in preference to the small ones.

PUBLIC PARKS AND GARDENS.

Mr. G. R. Patullo, Registrar of Oxford, read the following paper:

Coming first to the second part of my topic, I shall say little; for the question has already been dealt with by another member of our Association, who is much more competent for the work than I. Then, too, the desirability of public gardens in all our chief towns and cities is almost universally acknowledged, if not carried into practical effect. Of the character of such gardens, their number, size, arrangement, design and attractions, a layman must hesitate to speak in the presence of an audience that represents the expert horticulturists of the country. But that public gardens of such character and extent as are appropriate to the varying circumstances of the several towns and cities of the country, yea, and of villages also, would be a great attraction and would also be of material advantage, is undoubted. For the most casual observer will have noticed that one of the features by which a town or city is judged by a stranger is the attention that is given to beautifying it, by handsome tree-lined streets, well-kept boulevards and lawns, and tastefully arranged gardens, public and private. All these contribute to make up the character of a town or city, and by them too, the character of the citizens is determined in popular estimation. They indicate not only thrift, and a degree of prosperity, but also intelligence, good taste and culture. Hence they become important elements in attracting population and in making home-life worth living. All this and much more might be said about public gardens; but I desire specially to speak, by way of suggestion chiefly, upon the subject of public parks. Thus far Canadians may be said to have had little time for the consideration of matters other than those that pertain to the most practical side of daily life. The pioneers who have hewn from the primeval forest the beautiful homes and homesteads

that now dot our land were concerned chiefly in a struggle for existence. They had first to overcome the great obstacles that nature placed in their path and when that task was accomplished, as it was most nobly, they, alas, were for the most part, quite past the age to turn their attention to the work of beautifying and making more attractive the land in which they had cast their lot. That task is now ours. Our forefathers may be said to have represented the common school of our natural progress. We represent the high school, the collegiate institute and the university. That public parks are deemed desirable and indeed necessary in our national progress may be inferred by the action that has already been taken in establishing several of them by both the Dominion and provincial Governments. The first of these established was that at Niagara Falls. This in a sense is an international park, for the great State of New York, preceded the Province of Ontario in setting aside a reservation for park purposes immediately opposite that subsequently established by the Ontario Government. By this joint action, Niagara Falls—once a hissing and a by-word because of the petty devices that were practiced upon visitors to the World's greatest waterfall—is now one of the most beautiful and delightful spots for the tourist and visitor, and one to which he may go and enjoy to the full as cheaply as he may pay a visit to any city in the land. Thither go annually tens of thousands of visitors where formerly there were not hundreds, and there citizens of the two great Anglo-Saxon speaking nations of this continent can meet in friendly social intercourse let us hope may under the shadow of the great Falls the roar of whose thunder forever hush all sounds of strife and discord between those who are proud to own a common mother. The provincial Government has also established a public park in the northeastern portion of the province. The Algonquin Park, with a vast territory of forest land, with lakes, rivers and waterfalls, that are destined to make it a delightful place of resort for the pleasure seeker, the lone fisherman and the huntsman. At Rondeau also on Lake Erie, another park with somewhat similar attractions has been established, and others will doubtless follow. The Dominion Government, too, has most wisely taken advantage of the surpassing beauties of the Rocky Mountains scenery to establish a great national park at Banff. Apart from the natural attractions of this park it is rapidly becoming a popular sanitary resort because of the curative qualities of the baths there. All these parks have been established with the cordial endorsation of both political parties for each side of the House vied with the other in giving authority for the necessary legislation and expenditure.

But while our public park system is so far satisfactory, why not extend it still farther? The parks already mentioned are perhaps chiefly for the pleasure seeker, the tourist, the fisherman or hunter—in a word for those who, in a sense, least need the recreation and enjoyment which they may afford. Why not extend the system so as to include in their enjoyment and advantages all classes of the community? So as to make it possible for the poorest and the humblest citizen of the land to enjoy the free pure air and all the attractions that a pretty park affords? This is the question and the message that I have for the Provincial Horticultural Association. My meaning is briefly this:—Why should not only every city and town, but also every village and township in the province have a public park or parks? Is there one of them that does not offer the natural advantages therefor? And how many of them invite you by their great and transparent attractions to go in and appropriate them for park purposes? Speaking for this county, and in point of picturequeness it lacks the attractions that lake, river and mountain scenery afford, there is not a township, nor indeed a considerable village, where a beautiful park could not be acquired and established at a small cost. There the poorest citizen with his wife and family may go as opportunity offers to enjoy the pure air, the green sward, the shady grove and it may be the sweet song of the birds that are denied to him within the limits of their own humble home. Mothers and children would especially enjoy such a boon and the latter would surely wax stronger and better, and become healthier and happier men and women because of it.

There is much talk current now-a-days of what our country produces and what it manufactures. But its most important product, must always be its people. That they may grow up to be strong, healthy and happy is a first consideration. And whatever we can do to accomplish that is a national gain. Life must be made attractive alike to the

rich and the poor—to those whom Abraham Lincoln was wont to call the common people. If we are to be a contented, happy and prosperous people—a people united in the grand purpose of building up a new enlightened and great nationality on this continent.

Mr. RICE: I fully approve of the paper, and looking at the location of this beautiful city situated as it is among the everlasting hills, I have been thinking our friends might have a very interesting park here. I have often been pointed to a hill near here as being the loftiest in this section of Canada. (Hear, hear.) We always look at that with great admiration—with its rounded, beautiful form, the little patch of woods on one side, and all its associations, overlooking as it does the stream that runs below, and the railroad trains, and all that. Now, why not have the top of that hill made into a beautiful park, planted with your choicest maples that I see growing everywhere in this city, growing as they do only in Vermont and some highly favored countries, and thus have here one of the most beautiful spots on earth?

Mr. HUGGARD: In the last three years we have established three parks in the town of Whitby. The town lies back from the lake about two miles and it is not convenient for the people to get down to the lake for an hour's outing, so we have a four-acre park almost in the centre of the town just outside the business part. (Hear, hear.) A little further on, between two schools where the children want a place to play, we have an acre park; and last spring on the banks of the beautiful Lake Ontario—one of the finest on the world, and a bay that cannot be surpassed—we have twenty-five acres laid out. I hope the suggestions in the paper will be adopted by other towns more fully.

Mr. RACE: We have another American visitor who is the owner of one of the finest private parks in America, and knows how to make a private park; I think the audience would like to hear something from him.

Mr. WATKINS: I would add to the title of the paper so as to have it read: "Public and Private Parks." I believe that no expenditure of time and money is so valuable to the owner of a farm as a nice little park. (Hear, hear.) Every farm should have one, if it is only a quarter of an acre; it would become the loved spot of his life. My park was created from a natural instinct I had to go wild. I was always fond of anything that grew in nature, and I must have them about me. This instinct has led me to all parts of the world to see nature, and I planted my park so that I would be always in touch with nature. More than that, having a family of children I felt that if they were raised in close touch with nature, with the trees and flowers surrounding them, they would go right every time, and if I could have blocked out the course that my children have taken I could not have done any better. They have all gone right, and I believe the contact with my trees and flowers has largely contributed to their welfare. (Applause.) My park covers sixty-five acres, and it has been the work of spare moments during forty years of my life. I have planted almost everything that is indigenous to our country, and have also made it a geological field, gathering stones from all countries and places so that children coming there from schools and cities would have an opportunity to see the structure of the earth. The park is simply for the amusement of myself and family, but about thirty days in every year it is opened, and I furnish teams and ice and service and everything to entertain everybody that comes there. I have induced the Michigan Central Railroad Company to run their trains out, as they say at the price of oil and men, and say nothing about the wear and tear of trains, and bring out children from the cities; and when we get a great many peaches ripe we get a good many children that never ate a peach before, and fill them full—(laughter and applause)—and if you could see them eating a good peach and then another and another you would get your money's worth. (Laughter.) Nearly every field on my farm has a corner that is a little park—a lovely quarter of an acre that has been planted with deciduous trees or evergreen trees, and makes an evergreen spot. My roads are all decorated. At first I made a great error in planting straight roads with trees largely maples. Afterwards I thought better of it and planted alternate trees of different kinds, black walnuts and butternuts and all our deciduous trees, even oaks, and grouping them, and now they are beginning to look beautiful; it is a very great change for the better. (Applause.)

Mr. SNELGROVE: Have you birds?

Mr. WATKINS: I have them in fine numbers, and they never trouble the fruit at all except the sparrow; and I believe I would rather have them than any if there were not any other birds. (Laughter.)

Mr. SMITH: Mr. Watkins did not state the size of his farm. It is two thousand acres in one block, with something besides, so there is a chance for making parks.

Mr. WATKINS: I don't wish to lead you astray; I am a genuine farmer, and what I don't know about farming you can leave out. (Laughter.)

Mr. MCNEILL: It is a pleasant thing to hear this testimony of a good American friend coming over here and showing us how to do these things. (Hear, hear.) In some of the large English parks they do something of the same style, but I don't believe they do it with the overflowing generosity of our American cousins.

Mr. WATKINS: I have spent many a happy day in old England, and I have yet to meet a people that I was so at home with and who gave me so much pleasure as the people of merry England—(applause)—and I would say their hearty style of doing business hits me exactly. When I got tired of travelling about Europe I went to England to rest. (Hear, hear and applause.)

The SECRETARY: The Waterloo Society has been doing something in the way of a park in their town, and I am sure we would be glad to hear from Mr. Lockie, the President.

Mr. LOCKIE: I am afraid the Secretary gave our Society credit for more than it deserves. The park was originated four or five years ago. In pursuance of the Act that was passed by the Ontario Legislature allowing municipalities to borrow money for park purposes, our town very wisely bought a nice piece of land near the town with a very fine sheet of water on it, a beautiful spot with large trees about it, and laid it out for park purposes. It has been a great source of pleasure to the town, and even of profit, for people come from other municipalities to have picnics and excursions in order to enjoy our park. Last year our Society bought flowers and helped in this way to make the park beautiful and pleasant. We hope that it gave the park commissioners an idea that they will continually enlarge upon. (Hear, hear and applause.) I hope when the Fruit Growers' Association comes to Waterloo to hold their annual meeting they will see and enjoy our park. (Hear, hear and applause.)

Mr. CASTON: I think hunting is prohibited in the Algonquin Park, although Mr. Pattullo spoke of it as the huntsman's paradise; and I trust that noblest and most graceful animal that ever ran the Canadian woods—the red deer—will be preserved from total extinction. (Hear, hear.)

THE CULTIVATION AND MANAGEMENT OF HOUSE PLANTS.

Mr. SCARFF read the following paper:

The cultivation of flowers is an occupation that improves alike the body, mind and heart. It is an almost certain indication of purity and refinement. We can afford to cultivate and study flowers, if for no other reason than their cheerful surrounding. Many do without flowers because they think they cost too much time and trouble, but all things worth having cost considerable and anything worth having is worth working for. Oftentimes the partial success, or, in many instances, total failure, in the cultivation of flowers is due to the fact that we try to do too much. No one should have more plants than one can fairly manage or take care of; too often do we see many plants crowded together in a poorly lighted window, compelling each plant to take on a form never intended by nature, and foliage quite different from that desired by the owner. One of the chief requisites in the management of house plants is plenty of sunshine, next an atmosphere neither too dry nor close, and a uniform temperature, lower during the night than during the day. As the days become longer

and brighter, more room between the plants must be given; for nothing detracts more from the appearance of plants than standing too close when growing rapidly. More careful attention should also be given to proper ventilation on all suitable occasions. This is absolutely necessary to the health of plants.

The Soil. With regard to the soil best adapted for pot culture: Soil for pot plants should always be carefully prepared. For this there is no better foundation than well-decayed turf that is full of root fibres. Many plants would need nothing more; strong feeders should have manure added. Perhaps the soil that will best suit the majority is two parts decayed turf to one part of well rotted manure and one part sand, which will make a soil that will not bake.

Watering. Rain water is better than spring or well water. Hard water may be greatly improved by adding a drop or two of ammonia, or a little soda, a small piece about the size of a pea to every gallon of water used. Morning is the best time to give water, and evening next. Never water house plants when the sun is shining brightly on them. The supply of water must be regulated according to the demands of the plants. Apply when needed, but never in excess. The condition of plants and soil is the best guide. Never give water when the soil is moist to the touch. The leaves of all large-leaved plants should be thoroughly sponged off at least once a week with tepid water. This tends to keep the plants in health and free from dust. Nearly all plants require more water when in bloom than at any other time, more in a warm temperature than in a cold, and more when in a state of active growth than when at rest. Plants in open rooms usually require water once a day and some demand it twice. Drainage in the pots must always be attended to, as stagnant water at the roots will result in diseased plants and impoverished flowers.

Gas. Its use for illuminating is a drawback to plant culture in the same rooms. Plants are better off for being in rooms that are never lighted much artificially. If the plants can at night be cut off by partitions, or moved to unlighted rooms, it should be done. If not, harm may largely be prevented by covering them with paper covers while the gas is lighted.

General Management. Pay strict attention to airing, give air when opportunity offers; try to secure a uniform temperature without draught. All the light obtainable at this dark season is needed. Roll up the curtains clear to the top during the day. Give extra protection to plants during severe cold nights. Plants coming direct from the florist's often fail when set in a window at this time of the year, because the tender greenhouse plants are not used to the exposure in the much colder window. Be sure to get plants that are thoroughly hardened, and to warm the rooms where such plants are in the window sufficiently to carry them over this change in a gradual way. Be sure to give all plants in the window the space they require. Crowding is in no case desirable. For the better protection of plants near the window in severe cold nights, the plants may be taken from the window, placed upon the table in the centre of the room and covered with paper.

I have frequently been asked the cause of plants dropping the leaves. Whenever this occurs, we may be sure the health of the plant is impaired in some way. The plants may have been kept too warm or too cold, given too much water or not enough of it; they may have been injured by crowding or with strong stimulants, or allowed to become pot bound. The first thing to be done is to make a thorough examination. Knock the plant out of the pot and see if the soil is too dry or too wet, or whether the feeding roots are destroyed.

Injudicious watering or applications of strong liquid manure may result in the death of the plant. Re-potting in light and rich, rather dry soil, especially if a new or freshly cleaned pot is used, will give relief in most cases. The pot need not be larger than to give about an inch of soil around the ball of the roots, put it into a half-shady place, water enough to settle the soil around the roots, and give no more water until new, vigorous growth commences; the soil should be kept moist all through, but never wet for any length of time. Never use pots of a larger size than is absolutely necessary, and plunging them in cool ashes encourages root formation. One may readily enjoy a

succession of flowers all winter long by forcing a few at a time and replenishing as the bloom fades away. Hardy plants of every description dislike strong heat, preferring a cool, moist atmosphere, with plenty of air in mild weather and free access to the sun's rays.

For window culture, the plants should be started either in a cool greenhouse or sunny window in the domestic apartments, whence they may be removed to the living room as the bloom begins to appear. Give plants as much light as possible during the day, and darkness, with a lower temperature, at night. A uniform temperature of sixty to seventy degrees in the day time and forty to forty-five degrees at night will give the best results. Turning the plants towards the light should not be done unless done regularly.

Besides light, house plants require a good supply of fresh air. Ventilation is absolutely necessary.

Mr. HALL: What is the necessity for draining in new pots, or washing the leaves, or taking them from the window?

Mr. SCARFF: A great many persons are in the habit of giving too much water and thus drowning the plant out, hence the need of proper drainage. Washing the leaves is a great protection to those plants that have been raised in ordinary houses, where a certain amount of dust will always accumulate on the plants. I find it makes them much more healthy, and improves them very much.

Mr. GROFF: Gasoline does not affect the plants injuriously; I light my window with it entirely. Pots over four inches in diameter should be drained. The question of water is a vexed one among amateurs. The experience of the late Peter Henderson was that there was no difference between using hard or soft water as far as its effect was concerned. My own greenhouses and beds are all watered with hard water all the year round, and I am satisfied with the result; I obtain it from springs, being furnished by hydraulic rams.

Mr. HALL: You must remember that Mr. Peter Henderson did not grow his plants in the house.

Mr. GROFF: Of course a great deal depends on the soil.

Mr. LOCKIE: Does Mr. Groff use perfectly cold water in the conservatory?

Mr. GROFF: In a small house with the thermometer ten degrees below zero I have broken the ice and taken it in with the ice rattling in the cans and watered the plants of the house all winter with it. The temperature of the water would never be under forty degrees while the temperature of the house would be sixty at the time of watering For a short time a portion of the soil in the pot might be reduced to the mean temperature of about fifty degrees which could not be injurious, and that would only be for a short time. I practised that for some years without an injurious effect.

Mr. W. E. SAUNDERS: The presence of lime makes the difference between hard and soft water. Lime being added to many soils is a great advantage; yet I would not recommend hard water as preferable to soft. The Creator waters his plants with soft water. (Hear hear.) I don't know that we could do much worse than follow his example. Suppose I forget to water a plant, and at eleven o'clock I notice it wilting, does Mr. Scarff mean that we should not water that plant while the sun is shining? It has five or six hours of sun yet to resist without water. It seems to me that refraining from watering plants when the sun is on them is like refraining from drinking when you are thirsty. If you are thirsty then take a drink. (Laughter.)

Mr. GROFF: I think Mr. Scarff's idea was that it should not be left until it required watering when the sun was shining. (Laughter.) I think the water that is gathered at the roots of plants may be considered hard water. During the early part of the past season we had no rain; all the moisture plants received was from this cold spring bottom, spring water certainly, and the result was most satisfactory.

Prof. CRAIG: Each gardener at the Experimental Farm follows with very great advantage the plan of using nitrate of soda just about the time the plants are coming into flower.

Mr. HALL: You will get the ladies to kill the plants if you give them that secret; they will give them too much. (Laughter.)

Prof. CRAIG: Dissolve one ounce of nitrate of soda in three gallons of water and use it about twice a week, and you will very readily notice the increased vigor of the plant and the luxuriant foliage you will have on them. It is one of the best tonics for geranium, than which I don't know any house plant better suited for cultivation and that will stand more abuse and give more flowers; I don't think that the geranium is appreciated sufficiently by our flower-loving public and by the ladies.

Mr. GROFF: The whole question of watering may be summed up in this: The man who knows how to water knows it all, because on watering too much or too little the whole success of the plant depends. Over-watering will kill just as much as under-watering.

The SECRETARY: Mr. Saunders has a very large collection of house plants; I think we would like to hear something more from him.

Mr. SAUNDERS: I think it is better to use water in winter that does not produce a sudden change. I have been using city water in my conservatory; it comes to us at a temperature of about fifty-five, or fifty and I have attributed to the temperature of the water the fact that the plants have not come on as I thought they should, and I am about now to introduce a mixture of hot and cold until I get a medium temperature. I have been thinking that for spraying plants perhaps too warm water can hardly be used provided it is put on with a fine spray. Passing through the air it must lose almost if not quite all its superfluous heat, and reach the plants just in a gentle medium temperature which we might liken to that which the rain has on a warm spring morning.

Mr. DUNN, (Woodstock): Would it not be a good idea to take the flowers in the shed and water them there, if they suffer from the sun's rays.

Mr. GROFF: It has been claimed by the best experts that nothing is to be gained by warminig the water, and that there is no necessity of doing it, or of watering with soft water, unless it is as convenient as hard.

Mr. LOCKIE: I erected a small greenhouse last fall, and put up a tank pretty well elevated, and leave the water in there until it becomes the same temperature as the house, and I think that succeeds very well.

GARDEN AND HOUSE PLANTS.

The PRESIDENT: Our next subject on the programme will give hints on growing garden and house plants by Mr. Fred Mitchell.

Mr. FRED. MITCHELL of Innerkip, before reading his paper said: As an amateur and a professional I have had a life-long aquaintance with the subject under discussion, but I long ago discarded the custom of placing broken potsherds in the bottom of the pot for drainage, I found that if the earth was not of a fibrous nature there soon would be no drainage at all, that earth, when it is watered heavily will fill all the crevices in the pieces of pot which you place in the bottom. The drainage I use is the fibrous roots which I sift from my compost heap—a portion of the roots of the sod. These I place in the bottom of the pot, and I find it is the best drainage I can get. As it decays, if it does not become more open, it counteracts the washing down of the earth, and in pots with that drainage enough of the drainage remains till the plant is to be potted again no matter if that may be a year. I agree with Mr. Groff that one of the most important things in successful plant raising is correct watering. It is one thing which I have never had yet and I have as good men and boys in my employ as anyone has, but I have never been fortunate enough to secure one that fully understood watering plants. Anyone who has the knowledge naturally to define the amount of water that a plant needs will

generally be a successful plant grower in any part of this world. As to temperature of water, the only heed I have taken was that if the temperature of my house was already low I was careful not to use cold water and make the temperature still lower; if the temperature is high I have never been particular if the water was cold; if the temperature was overly high I considered it might even do good in a measure by counteracting it. I have known people when their plants would be frozen in the open air to put water on them. I have advised them constantly against this. This year, at the time of the severe frost some parties determined to prove whether I was correct or not, and they watered portions of their plants and left others unwatered; some sprinkled water even on black currant and raspberry bushes and they turned white as if a fire had passed over them, while the plants that had been left unwatered recovered their usual color. I shall just give you this advice, never water a frozen plant. Mr. Mitchell, then read his paper as follows:

As I noticed sometimes plants subjected to unnatural treatment, or placed in situations uncongenial to them, and where, perhaps, some other plant would give to the grower a far larger measure of satisfaction, I thought possibly such advice as I could give on these heads regarding some of our commoner plants might be more useful than the somewhat uncertain information I could give relating to newly introduced plants.

There are also general questions which I am frequently asked as to the reasons for failure, and the way to success in plant growing, answers to some of which I will endeavor to include.

I will commence with the GERANIUM, perhaps the best-known flowering plant of all. There is very little advice to give regarding it. A larger general measure of success is attained with it than with any other flowering plant. It is not exacting in situation or treatment. One of the very few mistakes made with it in open air planting is that some persons thoughtlessly use too many varieties. In prominent situations, where planted for display, this spoils the effect. One variety in a bed produces the most striking effect. For this purpose no other variety yet introduced equals the well-known Heteranthe, or, as it is often called, "*Double General Grant.*" *Bruant* is a much recommended variety of the same type and of nearly the same color. I find it to be not of nearly so good a constitution. *S. A. Nutt* is the best very dark-flowered variety for the garden. White and light-flowered varieties are never a perfect success in the open air. *Mrs. E. G. Hill* is one of the best salmon-colored varieties for the garden. There are very many varieties equally useful for pot culture.

There is perhaps no other plant of which so many are yearly bought and with which so small a measure of success is attained as the large-flowered FUCHSIA. The fuchsia is not exacting in the matter of soil or even in the amount of water it receives, but it is imperative that the temperature should not vary excessively and particularly that it should not run extremely high. As a spring and summer flowering plant for a cool conservatory it is very useful. I have attained the highest degree of perfection with these large-flowered fuchsias by placing the plants when commencing to bloom far from the glass on a low bench or on the ground itself, where the temperature is moderately low and even. In such a situation these plants are very beautiful. The variety known as *Storm King* is the most easily managed of all the large flowered fuchsias. The smaller-flowered varieties, which have been less improved from their original species, are many of them plants of easy management.

The large flowered *Cannas*, of which so much was expected and promised when they came out a few years ago, have not been universally satisfactory. Failure, I notice, is generally due to planting in shaded situations or insufficiency of water during dry terms. Cannas require an open sunny situation and plenty of water artifically applied in the absence of rain.

The plant known as *Caladium esculentum* requires the same treatment and situation as the Canna

A plant which used to be a common garden plant, and which, when I was a boy, I used to see a striking object in the garden plots of that day is *Monarda didyma.* It is

very showy when in flower, and remains in bloom a long time. It is an excellent plant for the background of a lawn or among trees skirting a driveway. It is one of the very few plants which will flourish under the shade of trees. It is a native plant and is generally found on cool moist banks in partial shade. It is becoming rather rare.

One of the very best summer conservatory plants, and perhaps the least understood, is the *Tuberous Begonia*. In its variety of form and color it is a brilliant display in itself throughout the whole summer. The greatest and brightest display can be secured by it alone if properly managed. Like the fuchsia, a rather low and even, summer temperature is necessary to the most perfect results.

The glass should be whitened or shaded in some way as soon as hot, bright weather may be expected. As for most fine rooted plants an open porous soil is the best, but success may be attained with it in soils quite different from this, if the temperature is kept right. The bulbs can easily and safely be kept through the dormant season in any cool cellar. Some would-be authorities tell us the temperature should never go below fifty in the place in which the bulbs are stored. There is nothing in this; a low temperature is in no way injurious, if it does not go below the freezing point.

Enquiries are often made of florists for plants which will withstand the effects of coal gas. I may say, as I have often said, that there is no plant to which coal gas is not, more or less, injurious. Plants with hard coriaceous leaves do not so quickly *show* the effects of it. Neither do plants, which remain inactive for a period, show immediate effects of it during the period of their inactivity. But to all plants coal gas is poison, slow or quick, according to their nature or to the condition in which they may be when subjected to it. Plants grown by florists when first removed and subjected to ordinary dwelling-house conditions, will often (even if no coal gas be present) be affected in appearance by the change to greater or less degree. The usual reason for this is that the air in the dwelling is drier than it is in the greenhouse. If the dryness is not extreme the plant will soon accommodate itself to its new conditions. But if the air be so dry as to be of a burnt or kiln-dried nature the plant will never flourish.

Enquires are often made as to the amount of water house plants should receive. A general rule is that water should be sufficiently withheld to allow admittance of air to the roots every two or three days at least. Saucers which are often used in dwelling-houses under the pots should only be used to catch such water as may drain from the pots when watering. The only common plants which will thrive with the saucers constantly filled with water are Sedges and Callas.

There are no hard and fast rules for the management of plants. He or she will be the most successful who makes a study of the general and individual nature and necessities of plant life.

Mr. GROFF: I would like to ask Mr. Mitchell if his reference to tuberous begonias referred to them as house plants, conservatory plants or bedding plants.

Mr. MITCHELL: I referred to them as conservatory plants, but I have experimented with them also as bedding plants, and I have not personally found them altogether successful. I have seen them growing to perfection in the open air with others but they have not done so with myself. They do the best in the open air or in places moderately sheltered, or where they do not receive much wind. It seems as if they cannot abide heavy winds.

Mr. J. CAMERON: Do you recommend putting pots in the sand for the purpose of keeping them damp?

Mr. MITCHELL: It certainly will do them no harm, and I think it might be some benefit. I believe that there is only a small portion of the people here who have seen the tuberous begonia at its best; it is most beautiful indeed, and makes a perfectly grand display. A summer conservatory with nothing in it but tuberous begonias can be made as bright and beautiful as it is possible to make it. (Hear, hear).

Mr. PARKER: Was not the injury that was done to these frozen plants with water done by watering at an improper time? If they were frozen during the night

and you allowed them to get the air too warm it seems to me the water might assist in extracting the frost from them, but if it was done a little too soon or a little too late of course it would be a serious injury.

Mr. MITCHELL: I think it would not possibly injure the plants so much if the water was put on in the way we have been told to-day was the proper way of spraying, that is, to fall in a light spray; but anything in contact with the plant that puts it in motion when it is frozen is sure to injure it. If any animal step on frozen grass it will leave a dead spot.

The PRESIDENT: We have with us two delegates representing the Michigan Horticultural Society, who will convey to us fraternal greetings from their Society.

Mr. RICE: Many people in Canada know of our state because it is the home of their children and friends. The State of Michigan would reach from Sarnia to Montreal and from Port Huron to Lake Ontario. We have more than one-half as many inhabitants in Michigan as you have in all Canada from ocean to ocean. It is the horticultural society of this grand state which sends you greetings to-night. Among the happy events of my life that I love to look back upon are the times when I have been privileged to meet with the bright men of this Association in the past. I think you know how to use people well, and you have such a studious disposition in studying all your work. Before I came to Woodstock I was told by a party who used to live here that the town was a long way behind the times; but when I looked around your pleasant streets and homes to-day and visited your active workshops I asked myself, where would you be if you were up to the times? (Laughter.) I looked around for poor men's homes, but found pleasant cottages surrounded apparently with comforts, pleasant yards, and everything looking neat and tasty. When we went over to your College and saw the young men there learning habits of industry as well as habits of thought, I felt that we would soon reap the advantage from this; and why? Because Canada is to us the reservoir from which we draw our young people. (Laughter). We are too busy in our country to raise up large families of children, but here in Canada you have the reputation of raising the finest hogs, sheep, cattle and horses in the world; and why not raise the finest stock of the other animals? (Laughter). Now if you are going to send that stock over to us, don't send scrub stuff; we have had enough of it. (Laughter). My daughter after passing through this beautiful country around Woodstock and valleys around London and the Grand River, and those vineyards down about Winona, said to me: "Papa, I see now why it is that only the meaner class of people come from Canada to our country." I asked, "Why?" and she answered, "They have such a beautiful country that none but a mean man would leave it." (Laughter and applause). It is often hinted that you would like to become part of the United States; but don't do it. (Hear, hear; and a voice, "Don't be afraid.") We know Michigan would be so eclipsed that we would have to sell right out and move down here, and you would become the greatest and grandest and most glorious spot on earth; no other spot would be so beautiful, so thickly inhabited, so filled with the industries of all sorts as this portion of God's footstool. No other portion is supplied with such water powers; you can manufacture for all the earth. Now just stay as you are; don't rival us too much; don't get too big. (Laughter.) Canada is often represented as our younger sister. Well, we are proud of her; she is a nice, spruce girl, and a pretty lassie. (Laughter.)

Mr. WATKINS: When our President at our last meeting asked me to go to the State of Illinois as a delegate I said no; then he said, "Go down to Indiana;" I said, "No, I don't feel like it;" but when he asked me to come over to Ontario, I said I would do that with the greatest pleasure. (Applause.) Some of you might wonder why. It is a very difficult route—I have to come four or five railways to get here. But the reason I came was that three or four years ago I had the happiness to be a guest of your Agricultural Society, and if I ever had a happy time it was then. I met a great many men that I have been very glad to have known—Frederick Stone, of Guelph, and the Snells, and a lot of people that were a delight, and I knew that I should come to just such another place here, and I did. I am happy to be with you to hear your bold and

careful and crystallized way of talking of subjects that you take up. You know that you have the future horticulture in your hands. There has been an allusion to annexation. I don't believe the people of the United States entertain the least idea of it. Not that they would not get the best people on earth, but we have had a bitter experience in our civil war in trying to hold down an immense territory. It would be a poetic thing to see this continent all governed by one people, but I think in the nature of things it would be impossible for any one government to hold so many classifications and environments and soil and conditions in one people. People are jealous, and politicians are tricky, and it would make trouble, and it would cause wars and bloodshed, and injure all parties. The best thing for us is a genuine, square, honest, fair, fraternal reciprocity. (Hear, hear, and applause.)

The meeting, which had been enlivened by several musical selections, closed with the national anthem at 10.30 p.m.

THIRD DAY—MORNING SESSION.

The Convention resumed at 10 a.m.

On request of the President, Mr. McNeill read the report of the Nominating Committee.

THE OFFICERS FOR 1896.

President, M. Pettit, Winona, *Vice-President*, W. E. Wellington, Toronto; *Secretary-Treasurer and Editor*, Linus Woolverton, Grimsby; *Directors*: W. S. Turner, Cornwall; R. B. Whyte, Ottawa; George Nicol, Cataraqui; Wellington Boulter, Picton; Thos. Beall, Lindsay; R. L. Huggard, Whitby; W. M. Orr, Fruitland; A. M. Smith, St. Catharines; J. S. Scarff, Woodstock; John Stewart, Benmiller; T. H. Race, Mitchell; Alexander McNeill, Windsor; G. C. Caston, Craighurst. *Auditors*: A. H. Pettit, Grimsby; George Fisher, Burlington. *Representatives* on the Board of Control of the Ontario Fruit Experiment Stations: Messrs. W. E. Wellington, A. H. Pettit and A. M. Smith.

The Report of the Nominating Committee was adopted as a whole.

The PRESIDENT: I thank you for the honor you have done me in electing me for a second term, and I only ask for a continuance of the kind assistance and consideration I have received at your hands during the past year. I assure you that I shall do all in my power to forward the great industry that we have here represented. (Applause).

REPORTS OF EXPERIMENT STATION BOARD.

The SECRETARY: The operations of the experimental stations are so extensive, and the report is so bulky and so much in detail, that it would exhaust all the patience of the members to hear it read.

Mr. A. H. PETTIT: As this report is so bulky and will be published in our annual report, I would suggest that we pass it over, as we have so much to be done at this session.

TREASURER'S REPORT FOR THE YEAR 1894-5.

Receipts.	$ c.	Expenditures.	$ c.
Balance on hand Dec. 1, 1894	140 87	*Canadian Horticulturist*	1,666 95
Members' fees	2,477 47	Salary Secretary-Editor and assistant	1,200 00
Government grant	1,800 00	Cromo lithographs	272 00
Advertisements	243 62	Plant distribution	262 24
Binding and bound volumes	34 47	Directors' expenses	238 98
Back numbers, etc	11 02	Commission	231 78
		Affiliated societies	191 52
		Postage and telegrams	152 23
		Express and duty	113 14
		Printing and stationery	105 91
		Stenographer	80 00
		Illustrations	57 20
		Committees	54 85
		Binding of volumes	34 69
		Advertising	24 36
		Discount	19 98
Amount due Treasurer Dec. 1, 1895	0 38	Petty cash	2 00
	$4,707 83		$4,707 83

We, your auditors, have carefully examined the books and vouchers of the Treasurer and find them to agree, and that they are most neatly and correctly kept.

A. H. Pettit, Geo. E. Fisher, } Auditors.

REPORT OF FINANCE COMMITTEE.

Your Finance Committee, having examined the Treasurer's accounts, have pleasure in testifying that the payments made during the past year were justifiable in the best interests of the Association, and in accordance with the objects for which our Association exists. But, in consideration of the fact that we have overdrawn our account, we would recommend that in future all paid delegations and committees sent out be as small as is consistent with the best interests of our Association.

A. M. Smith,
W. M. Orr.

On motion of Mr. Pettit, the Auditors' Report was adopted.

REPORT OF SECRETARY, 1895.

The membership of our Association during the past year has considerably increased. Last year the total number of paid members was 2,104, this year it is 2,472. As you will see from the Treasurer's report, the gross receipts from members' fees this year has been $2,477.47, and the commission allowed on club lists amounted to $231.78.

This increase has been in a large degree due to the praiseworthy efforts of our director for district No 5, Mr. Thos. Beall, who, a year ago, laid before us his scheme for enlarging the work of our Association in a paper read at the last annual meeting, and probably no man could be better fitted to do this work than Mr. Beall. He is methodical in his work, and knows how to approach the prominent men in each locality in such

a way as to insure their confidence in his proposals. Through his efforts the following affiliated horticultural societies have been formed :

Niagara Falls South, 100 members; Woodstock, 94 members ; Lindsay, 90 members ; Paris, 67 members ; Port Colborne, 61 members ; Brampton, 63 members ; Port Hope, 75 members ; Waterloo, 70 members ; Trenton, 60 members ; Napanee, 58 members ; Grimsby, 58 members.

I believe that it is the true way of enlarging the work of our Association, because it means a large number of local organizations in closest sympathy with our work.

You will be interested in knowing what was done in the spring of 1895 in the way of plant distribution. The following is a list of the plants distributed :

Pearl gooseberry	1,164	plants.
Green Mountain grape	336	"
Rosa rubifolia	381	"
Cotoneaster Vulgaris	155	"
Gabriel Luizet rose	99	"
Sarah raspberry	88	"
Douglas Fir	65	"
Pinus Ponderosa	57	"
Strawberries (sets of four plants)	18	"
Smith's Giant raspberry	3	"

These were wrapped with more care than usual with damp moss in oiled paper and an outside wrapper of heavy paper. They were mailed as fast as ready, the last being mailed on the 11th of May. It would appear that this distribution has given more than usual satisfaction, nothing but words of appreciation and satisfaction being received from subscribers. I have taken unusual care to have everybody pleased, because in time past there has been a good deal of complaint. In cases where no plant has been chosen by the subscribers I have sent them such plants as I thought would be acceptable. Our special thanks are due to Professor Wm. Saunders, Director of the Central Experimental Farm, Ottawa, to whom we are indebted for a large proportion of the stock sent out.

It is a question for us to consider in the near future, if not at this meeting, in what manner we shall continue the plant distribution. It is experimental work of a slow kind. The reports are scantily made and the chief good of work consists in scattering far and wide valuable new varieties of fruits or flowering plants. I would suggest that the experimental part of this work be entirely given over to the Board of Control of the Ontario experiment stations, and that only such stock be distributed among our members as from time to time is proved to be of value, either by our own stations or by the Dominion experimental farms, or as may for other reasons be considered worthy of distribution.

The printing of the journal is still done by Messrs. Dudley & Burns, of Toronto, and the average expense, including engravings, has been $125 per month, not including colored plates. The work is well and faithfully done, though occasionally behind in publication. Sometimes this is my fault, and sometimes it is the fault of the printers, but I assure you I am trying my best to have it issued as soon as possible after the first day of each month.

The colored plates have been continued in most issues of 1895. I find a certain class of subscribers highly appreciate them, and I think it would be a great mistake to wholly discontinue them ; still, with your approval, I propose in future to increase the number of engravings and lessen the number of colored plates, unless such lithographs can be secured as will more truly represent the actual size and coloring of our fruits than some of those which have appeared in the past. If our funds would permit, I would suggest the making of some original colored plates from nature, giving the true size and color of the fruits as grown in Canada. These would prove of value, and would add much to the high standing of our journal and of our reports in foreign countries. As an

example of the good work that might be done in this line, I would refer you to the fine plates, true to nature, which illustrate the "Bulletin of Agriculture and Floriculture," published in Gand, Belgium.

With all economy, I find it a great difficulty to keep the balance on the right side. We need more money for our work. Our industry is the most important one in Canada. The dairymen have received an addition to their grant, and we are quite as well entitled to it as they are. Our directors should have more than bare expenses; our journal needs additional expense put upon it, and lecturers should be sent out to affiliated societies.

I would suggest that a committee be appointed to interview the Minister of Agriculture on this subject, asking that our grant be increased for the purposes above mentioned.

This report was received and adopted.

REPORT OF NEW FRUIT COMMITTEE.

D. W. Beadle: The New Fruit Committee are able at this meeting to give you a verbal report. Owing to the frosts the number of seedling fruits and new fruits received this year has been comparatively very few. I took some pains to communicate with all who had sent new fruits to this Association in years past, writing over a hundred letters, and I have received replies from some of them. Anything of any importance will be detailed in the report which I will prepare and send to the Secretary.

Letters were sent to all those who had, previous to 1894, sent samples of seedling fruits which had been favorably mentioned in the reports of this Association, but owing in large measure to the frosts of May subsequent to the very warm weather that had forced vegetation into unusually rapid development, comparatively few were able to comply with our request to be favored again with samples of these fruits.

Notes were carefully made of such as were received, a synopsis of which is herewith presented as follows:

From Mr. J. C. Bull, Weston, Ont., were received samples of apples grown from seed of the Rambo, the trees all of the same age, somewhere between thirty and forty years. These were sent to Mr. Craig, but the letter describing them was sent to the chairman, which stated that the fruit was also mailed to him. After waiting some days without any tidings of the fruit, and not having received any reply to his inquiry whether the fruit had been sent, the chairman sent Mr. Bull's letter to Mr. Craig, and shortly after learned from him and from Mr. Bull that the apples had been sent to Mr. Craig and that he had been waiting to learn whence they came. Owing, probably, to this delay notes were not taken by Mr. Craig of all of the numbers. Those taken are dated September, 1895.

No. 1. Size, medium; form, round, regular; skin, yellow, with faint blush, and interspersed with numerous black dots; stem, large, slender; cavity, broad and smooth; calyx open; basin shallow, wrinkled; flesh, yellowish, juicy, melting, pleasant sub-acid; rather promising. Mr. Bull says No. 1 is smaller than usual, the tree a good bearer, but rather delicate.

No. 2. Mr. Bull says the tree is very productive and hardy, the fruit usually larger than sample sent. No notes by Mr. Craig.

No. 3. Size large; form, roundish conical, regular; skin, greenish yellow with numerous dots; stem, moderately stout; cavity narrow and deep; calyx, open, basin shallow, roughly wrinkled; flesh, white flaky, juicy, quality good, sharp sub-acid; texture, rather tough; decidedly promising; more color wanted. Mr. Bull says fruit fairly represented by sample, tree hardy and productive.

No. 5. Mr. Craig notes it is not as valuable as Nos. 1 and 3; smaller, more conical, with stripes; quality medium. Mr. Bulls says, "a hardy tree, bears very well, but not so heavy as some of the others." He also says No. 4 is very hardy and productive; No. 6 a good bearer and hardy, fruit sweet. But no notes appear to have been taken by Mr. Craig of Nos. 2, 4 and 6.

Seedling apple from W. H. Leef, Orillia, Ont., October 4th, 1895. Description taken from Mr. Craig's notes. Size, medium; form, oblate, somewhat irregular; stem, not mentioned; cavity, broad, moderately deep, russeted; calyx, not noted; basin, shallow, somewhat irregular; flesh, yellow, juicy, mild sub-acid, pleasant, fair quality; season, October and November. Fairly promising. No mention of the tree.

Seedling apples from Watson Griffin, Montreal, October 5th, 1895.

No. 1. Shiawassee Beauty type. Size, large; form, oblate; skin dark crimson. Much overripe, October 10th.

No. 2. Probably Autumn Strawberry or foundling. Exact in taste and appearance. Now over-ripe, October 10th.

No. 3. Like Westfield Seek no Further. Size, medium; form, oblate; skin, dark green interspersed with crimson markings; flesh, juicy, brisk sub-acid; season, midwinter. Promising.

No. 4. Size, large, Alexander type; skin, greasy, overspread with purplish red; flesh, yellowish white, tender, juicy, melting, sub-acid; quality good, much better than Alexander. Worthy of further trial.

Such are Mr. Craig's notes on these apples from Mr. Griffin.

Seedling apples from C. H. Roberts, Paris, Ont.

Harold. Size, medium to small; form, oblate with conical tendency, regular; skin, smooth, glossy, with bloom, dark crimson, with greyish, russety patches near the cavity; stem, short and stout; cavity, broad and moderately deep; calyx, closed; basin, small; flesh, white, firm, somewhat pithy, juicy, but not strikingly so, sub-acid, quality, medium to poor. Season Christmas.

Percy. Small, resembling Longfield in size and appearance, but somewhat tough and woody in texture.

Charlie. A small, crab-like apple of bright, attractive appearance and good quality and a keeper, but too small. Such are Mr. Craig's notes of Mr. Robert's apples.

Seedling apples received from Mr. McD. Allan, Goderich, Ont.

Breckenridge. Mr. Allan says grown by John Breckenridge, Goderich, a great bearer, long keeper, and towards spring of excellent quality. Resembles Northern Spy. Size, medium to large; form, approaching oblong; ribbing, very obscure, sometimes wanting; skin, yellowish green, partly covered with stripes and splashes of red, thick and tough; stem, slender; cavity, deep and broad; calyx, open; basin, shallow, almost wanting; flesh, white, flaky, juicy, sub-acid, with Northern Spy flavor; said to keep all winter. Worth cultivating.

Jordan. Russet type. Size, eight and one-quarter inches in circumference, two and one-half inches long; form, regular, roundish oval; skin, greenish yellow, thinly covered with light russet, with russet more dense in numerous patches and sparsely sprinkled with grey dots; stem, three-quarters of an inch long, moderately stout; cavity varies from broad and shallow to deep, narrow and lipped; calyx, prominent and closed, occasionally open with broad segments; basin, shallow, smooth; flesh, a greenish yellow, fine grained, moderately juicy, breaking, mild sub-acid, rich, pleasant, quality, very good, resembles Pokeepsie Russet in flavor; season, late winter. Deserves attention. Mr. Allan says: This apple is grown by F. Jordan of this town. It is a long keeper and of fine quality when ripe. It will easily keep till June.

Seedling apple from Milton G. Bruner, Olinda, Ont., who suggests for it the name Ella. Size, medium; skin, yellow, striped with red and crimson; flesh, white, melting, moderately juicy, mild sub-acid, quality fair; season November to January.

Two Seedling apples from Thos. Connolly, Lindsay, both yellow, fairly attractive in appearance, but not good enough to be commended for dissemination. Notes of Bruner's and Connolly's apples by Mr. Craig.

Seedling apples from J. Cuppage, Orillia.

Pioneer, No. 1. Size, medium to small; form, roundish conical; skin, yellowish green, with a ruddy check, and thickly covered with irregular russet dots; flesh, yellowish white, not juicy, mild sub-acid, quality poor; season, early winter.

No. 2. Size, about ten and one-half inches in circumference; form, oblate; skin, mostly covered with light red, abundantly streaked with deeper red and sparsely sprinkled with very minute specks; flesh, yellowish white, almost coarse, juicy, sub-acid, quality poor.

McLeod, No. 3. Size, medium to small; poor in quality; seemingly a November apple not worth disseminating.

Diamond, No. 4. Size, medium to small; form, oblate; skin, greenish yellow, thinly mottled and splashed with red in the sun; flesh, white, slightly tinged with greenish yellow, coarse, moderately juicy, very mild, sub-acid, not rich but pleasant; quality not good enough to warrant its dissemination.

Kean's Seedling, grown by Rev. Thomas Williamson, Orillia, sent by Mr. G. H. Hale, Orillia. Size, medium, nine inches in circumference and two and one half inches high: form, conic oval, slightly oblique; skin, for most part a purplish red on yellow ground, mottled and splashed with a darker shade, thickly sprinkled with light grey specks, which appear almost white in contrast; stalk, three-quarter inches long; cavity, deep, nearly triangular, slightly lipped; calyx, open, segments long pointed, reflexed; basin, large, of moderate depth, slightly wrinkled; flesh, yellowish white, moderately juicy, flavor without character, quality poor.

Two apples from Franklin Crandall, Lindsay, Ont. Received December 6th.

Red Rock. Tree, a seedling, hardy; fruit, size medium; form, conic oblate; skin, light yellow, overspread with red, splashed with deeper red and sparsely sprinkled with small whitish dots; stalk, very short and stout; cavity, broad, deep, slightly russeted, and irregular in outline; calyx, small, segments short, open; basin, irregularly corrugated, broad, of medium depth; flesh, yellowish white, coarse, juicy, sub-acid, quality not quite good; a good keeper, but apt to rot at the core.

Empress. Tree came up on a spot where a Baldwin was once growing, it is now fifteen years old, has been in bearing ten years, bears every year. In 1894 the crop was three barrels, in 1895 was seven barrels. It is a free grower and extremely hardy. Fruit, above medium, ten inches to ten and one-half inches in circumference; form, oblate, flattened at both ends; skin, greenish yellow, with a solid carmine blush where exposed, splashed with deeper shade and thickly sprinked with minute dark brown specks margined with green; stalk very short, and stout; cavity, broad; moderate depth, slightly russeted around the base of the stalk; outline irregular, with a slight lip; calyx, open; segments, broad and short; basin, broad and deep, not wrinkled but somewhat irregular and precipitate. Flesh, nearly white, almost fine grain, mild, sub-acid, juicy, pleasant flavor; quality very good; core, small. Mr. Crandall says the fruit is at its best about April when kept in a cool cellar. A very promising variety, worthy of further trial.

Apple from Mr. John Miller, Markham, Ont. December 14th, 1895. Tree forty years old, was growing on the farm when Mr. Miller took possession twenty-eight years ago; is healthy and a regular bearer. Fruit, of medium size; form, roundish oblate; skin, smooth, yellow, red on one side, and splashed all over with bright red; stem, very short, not very stout; cavity, deep, narrow, smooth, lightly russeted; calyx, closed, segments, broad and short; basin, shallow and uneven; flesh, yellowish white, fine grained, juicy, mild, sub-acid, pleasant flavor; quality good; core medium, seeds very plump; season, December and January. An attractive apple, no better than others of same season now in cultivation, but may prove valuable in some sections on account of the hardiness and productiveness of the tree.

The following descriptions are from notes taken by Mr. Craig. For varying reasons Mr. Craig was not able to forward samples of all of the fruits received by him to the other members of the committee, therefore in such cases the description given is credited to Mr. Craig, from whose notes they are taken.

Seedling apple from A. W. Forfar, Ellesmere, Ont., reported in 1869 by Fruit Growers' Association of Ontario. Fruit, of medium size; form, oblate conical; skin, a clear golden yellow, with a diffused pink blush; stalk, slender; cavity, broad, moderately deep and slightly russeted; calyx, open; basin, shallow and plaited; flesh, white, flaky, moderately juicy, firm, mild sub-acid, with sweetish after taste, flavor pleasant, good to very good, core small; season, September and October. In good eating condition September 24th, 1895.

Seedling apple from Mr. Seth C. Wilson, Whitby, Ont. Fruit, of medium size; form, roundish, ribbed; skin, greenish to yellow with dark dots; stalk, short, one-half to three-quarters of an inch; cavity, deep and smooth; calyx, open; basin, ribbed, small and deep; flesh, white, crisp, juicy, brisk sub-acid, breaking, flavor pleasant; season, August. Resembles in a general way Grimes Golden, with less regularity.

Seedling Plum, from Allen Bros, Winona, Ont., August 9th, 1895.

No. 8. Examined August 24th. Fruit of medium size, form egg-shape, skin green. Too badly shrivelled to gain an idea of the quality.

Seedling Peaches, from H. A. Bailey, Amherstburg, Ont. Both samples in poor condition. September 20th, 1895.

No. 1. Overripe when received; one of them quite decayed, but apparently of good quality.

No. 2. A clingstone, of fine appearance, but watery and of poor quality.

Scions of the most promising varieties, above noted, have been secured by Mr. Craig, and root-grafts will be available for distribution next spring to the experimental fruit stations.

Committee: D. W. Beadle, Toronto, Chairman; John Craig, Ottawa, Ont.; A. McD. Allan, Goderich.

REPORT OF COMMITTEE ON FRUIT EXHIBIT.

Your committee appointed to examine the fruit exhibit upon the table have to report that they find a very fine display of old and new fruits made by Mr. W. H. Dempsey, of Trenton. Among his new apples worthy of note we observe a medium sized roundish, dark red one, very handsome, somewhat resembling a Spy—a cross between that old variety and Golden Russet. Also another cross between those two varieties, named Walter, previously shown at Peterborough and described in the report of that meeting. In his exhibit are also seen very fine specimens of Hubbartson's Nonesuch, Westfield, Ontario, Newtown Pippin, Lord Burleigh, McIntosh Red, Stark, American Pippin, etc.

Mr. W. S. Turner, of Cornwall, shows a handsome plate of Gideons, and some very fine McIntosh Red, La Rue, Wealthy, Red Bietgheimer, Canada Baldwin, and specimens of a few other older varieties.

Mr. A. M. Smith, St. Catharines, shows the Princess Louise apple, six varieties of pears and well preserved samples of the Niagara and Vergennes grape.

Mr. L. Woolverton, of Grimsby exhibits a very fine sample of Cranberry Pippin, Blenheim Pippin and Princess Louise.

Mr. H. Jones, of Maitland makes an attractive display of ten varieties of apples, among them the Red McIntosh, an extra fine Fameuse, a fair sample of La Rue, Pewau-

kee, Ben Davis, Wealthy, Longfield, Blue Pearmain, Scott's Winter, and a handsome seedling named Scarlet Pippin. The latter is a handsome, reddish, medium sized and very attractive apple of fair quality.

Another attractive exhibit is one by Prof. Craig, of Ottawa, brought from the Experimental Station in British Columbia. Among this exhibit are large sized specimens of the Vaudevere, Stark, Mann, Ribston Pippin, Twenty Ounce Pippin, etc. Prof. Craig also shows a number of varieties grown at the Experimental Farm, Ottawa.

Mr. L. B. Rice, of Port Huron, shows a sample of Ben Davis grown in Missouri, which seems to be matured much in advance of the same variety grown here.

Mr. W. Newton, of Woodstock, exhibits some samples from a tree bought for the Newtown Pippin. The samples resemble, slightly, that variety in shape and color, but not at all in quality or season.

Mr. R. L. Huggard, of Whitby, shows a seedling which he claims to be a long keeper, and the tree a regular and heavy bearer. The apple is of medium size, of the Colvert form, but does not appear to have much quality.

T. H. Race, }
G. Nicol, } Committee

The Secretary thought it would be well for Mr. Race to call attention to anything specially worthy, and let the details come in the printed report.

Mr. Race: the only thing that the committee have to report specially are some of those seedlings shown by Mr. Dempsey. He has shown some very fine results from crosses between the Northern Spy and the Russet. The peculiarity of these apples is that they have the characteristics of the Spy partially; however, they are very fine samples. The next very nice exhibit is shown by Mr. Turner, and some very fine specimens shown from British Columbia. The specimens that were shown from the Experimental Farm at Ottawa we have said very little about. They don't come up at all to the apples produced of a similar variety farther west. Special mention should be made of the apples shown by Mr. Jones from the St. Lawrence district, called the Scarlet Pippin; it is a very handsome apple, medium size, of fair quality. Mr. Jones reports that it is a very salable apple down there, and one very much in demand. We cannot say that it would be an apple that should be very largely cultivated except for its appearance; and as Mr. Dryden represented to us here yesterday afternoon, it is quality that is going to tell in the long run in the British market and every apple market, and that has been my view for a great many years. A little flash and show may take for a time, but this apple has the qualities to recommend it for a long time.

Mr. Huggard: I would like to hear the committee's opinion of this seedling I brought from Whitby.

Mr. Race: There were two or three seedlings placed on the table which we could not say anything about. They are only medium in size, and they are not very well up in quality. There is not one of the seedlings shown that would commend itself very much. We don't think it is advisable to recommend the introduction of any of these new seedlings unless they come quite up to or a little above the varieties now in cultivation. We have some splendid apples now, the old standard apples, and have such a variety of them that we don't care to recommend the increasing of the number of varieties unless we can get a seedling that really comes above them in quality and every other character.

Mr. Huggard: The qualities of that seedling does not show itself till March.

Mr. Race: It is not better than the Mann.

Mr. McNeill: Will it be more prolific than the Mann?

Mr. Huggard: It is a heavy bearer, and quite heavy enough for the tree to carry, and on account of its good keeping quality and its high flavor later on I thought perhaps it would be commended. It has a spreading habit, a very thrifty tree, free from roughness of any kind. I admire it very much in the orchard.

D. W. Beadle: Would Mr. Huggard have the kindness to send about half a dozen of those apples about the time when they are in order and season for testing, and send a letter giving a full account of the tree, its hardiness, productiveness, and general habit of growth, and all the better if he can tell us something about the soil and average climate in which it is grown. He can send both the apples and letter to Prof. Craig at Ottawa, without charge, under a privilege granted us by the Government, and then Prof. Craig can send them to the other members of the committee and we will all get them without any cost to Mr. Huggard more than the trouble of putting them up and sending them, and the apple will get all the consideration that it deserves and a full report at some subsequent meeting of this Association.

METHODS OF ORIGINATING NEW VARIETIES OF STRAWBERRIES.

The Secretary referred to a letter from Rev. E. B. Stevenson of Freeman, who is a specialist in strawberries and who has spent his life in originating new varieties. From him in the future we will hear some interesting things that will be of great value to us in our experimental work. (The Secretary read the following extracts from the letter from Mr. Stevenson):

It seems to be there has been no systematic effort either in Canada or the United States by those who have had the time and means to improve the strawberry. I am very much limited in both respects; but I am in a small way and in a somewhat systematic manner seeking to improve on the varieties we have at the present time.

There are so many points to be looked to and guarded in what we all are looking for, viz., the "*Perfect Strawberry.*" It has to be a perfect plant—strong and healthy. This is very important. The perfect plant must be free from rust. Some otherwise good varieties are spoiled by rust. A high system of cultivation, manuring heavily with nitrogen manures, serves to increase the tendency to rust; also certain conditions of the weather, situation of the beds, low lands, etc.

I have found very little rust when beds are situated on highest lands; whereas, beds on grounds seventy-five or one hundred feet below showed considerable rust. I have little confidence in a variety that is easily attacked by rust.

A seedling, a Wilson and Jersey Queen cross, that on elevated ground was quite free from rust, when it came to be removed to a lower situation, rusted so badly as to be of little value. On upland it was one of the most promising seedlings—productive, good size and quality, etc; in fact, an improved Wilson. I have found that a large per cent. of seedlings of Wilson blood, or rather breeding —whether they are seedlings of the Wilson or seedlings of other varieties with Wilson crosses—are more or less severely affected by the rust. A lot of seedlings from Burr's New Pine, crossed with Wilson, nearly every seedling from this cross gave fruit of superior quality like Burr's N. P., but the plants fairly burned up with rust as soon as plants were through bearing.

Probably 1,000 seedlings grow the Wilson and Wilson crosses were undertaken with the hope to secure a Wilson jr., that should possess all the valuable qualities of the Wilson, (which for so many years caused it to stand at the head as a market berry) with the addition of increased size, improved quality and more vigorous growth. It is, perhaps, needless to say the result was failure. Perhaps the Wilson can be crossed on some pistillate variety and the result prove highly successful. I have decided not to make any more experiments, using the Wilson as a pollenizer.

I may never reach in the way of a seedling a variety which shall be my ideal of a strawberry, but I shall aim for it, and never cease to raise seedlings as long as I have the time and opportunity.

Had I time and opportunity I would cross named varieties with a view of ascertaining which kind and crosses gave the best results. Then I would select this stock, breed

in and in—seek to develop an inbred strain that would produce its valuable qualities from seed. A staminate variety from such a breeding could be used to cross an outside named kind (pistillate sort,) and the seedlings would possess to an eminent degree the qualities of the male parentage. These seedlings (the pistillate sorts) could be bred back again to the staminate sire or to some other staminate variety of the above inbred strain. I am sure wonderful results would attend some such systematic method of breeding. have seen enough to satisfy me that there are great possibilities in this line of plant breeding.

A man must have means and leisure to carry out such a line of experiments. It is a most fascinating line of study ; much more than the mere testing new varieties, most of which are only chance seedlings picked up in fence corners and taken from stumps and stone heaps.

After a few years of such systematic breeding I think we would give much more valuable results. The method I have used in the past is : I take up the plants, place them in six or eight-inch pots—I do this in the spring for seed bearing, in late fall for fruiting—crosses I make under glass so as to control their fertilization. When I have several staminate varieties that I wish to use pollen from, it is needful to keep these staminates in a separate chamber or in some place apart. In fertilizing a staminate with another staminate the stamens have to be removed a couple of days before the flower would naturally open. Then when open apply pollen. There is need to apply the pollen several times in order to ensure a thorough fertilization, and have smooth perfect-shaped berries.

There is pleasure in testing varieties of other men's growing, but there is far more pleasure, a perfect fascination, in raising and fruiting.

"*Pedigree seedlings*" of you own, not that we find a prize in every variety, but we do find such a wonderful variety, size, shape, color, texture, quality, etc., that we are lost in wonder at these new fruit creations.

I have often wished that I could give more time to this sort of experimental work, but I have other demands on my time, but I manage to do something in the line of sought-for improvement with what degree of final success remains to be seen.

REPORT FROM OTTAWA VICINITY.

The Secretary introduced a report by Mr. R. B. Whyte of Ottawa, Director for District No. 2 as follows :

As I cannot attend the meeting at Woodstock, I send on the following few brief notes of the condition of the fruit growing industry during the past season in this district.

The season opened very favorably, and if it had not been for the severe frosts in May which ruined the strawberry and gooseberry crops, and seriously injured the others, we would have had one of the greatest fruit yields on record. The previous winter was most favorable, not very cold, plenty of snow, and no thaws to uncover the plants and expose them to cold winds. The weather during the summer was a great contrast to that of Western Ontario. Hardly a week passed without copious rains, which, with abundant heat, induced a most luxuriant growth in every thing that escaped injury from frost.

The severe cold in the latter part of May, which was so disastrous all over the country, utterly ruined the strawberry crop in most sections in this district. In some localities there was a fair crop but my experience was that of the great majority of growers, all we got was a few quarts of nubbins, hardly a good berry in the whole plot.

Almost as disastrous was the effects of the low temperature on the gooseberry. For the first time in my twenty years' experience in gooseberry culture, such varieties as Downing, Houghton, etc., usually so prolific, failed to bear a good crop. Out of over

forty varieties, the only one that had anything worth picking was the Whitesmith, my ten bushes of that variety producing more than 140 plants of other kinds. Singularly enough, the American varieties suffered more than the more tender foreign ones. Downing, Pearl, Montana Seedling, Smith's Improved, and Houghton, were all alike bare of fruit. I hope after another season's experience in growing foreign varieties to report, through *The Horticulturist*, my experiments with over forty kinds.

Though so closely related to the gooseberry, the red and white currants were very little injured by frost. The crop, while not so good as the previous season, was very fair. Another year's experience has established the great superiority of Moore's Ruby over all others as the best red currant. In quality it is away ahead of any competitor, red or white, large in berry and long in bunch, many of them containing twenty-four berries in the raceme. It is a better bearer than Fay, and a much more vigorous grower. It is not nearly so well known as it deserves to be. Another variety that promised well is the Wilder. It is more acid than Moore's Ruby, but in every other respect it is a close rival.

Raspberries were very satisfactory this year. No small fruit grown in this district is so uniformly profitable, for the space occupied and the labor expended, they give a greater return than any other small fruit. Cuthbert, Golden Queen and Shaffer are the standard varieties here. There are probably more Cuthbert's grown than all other kinds put together. Some growers are finding the Shaffer very profitable. One that I visited last summer told me that it was more profitable than even Cuthbert. At first the color was found fault with, but any one who tried it always wanted it again; the above three kinds are almost the only ones grown for market here. But for home use softer and sweeter berries are preferred, such as Clark, Herstine or Heebner.

Black caps or blackberries are very little grown, not being found profitable in this section.

Plums, of late years, have been a failure here. We have never been able to grow the Domestica type successfully. The winter cold is too severe, and our native red plums are so subject to rot and blight that they are being generally cut down. Our only hope now is in the Western Americana type, as De Soto, Weaver, Wolf, Wyant, Hawkeye, etc. These are being somewhat extensively planted, and have so far proved hardy and free from disease.

The only apples grown to any extent here are the summer and fall varieties, such as Tetofsky, Duchess, Yellow Transparent, Wealthy, etc. These were a very good crop, and unusually free from codling moth, scab, etc., though fire blight was pretty bad in some places.

Grapes were very generally a failure. They were almost as much injured by spring frost as the strawberry. Those that escaped the frost ripened perfectly—even such late varieties as Iona.

With strawberries, gooseberries and grapes a failure, and raspberries, currants and apples only an average crop, it has been a poor year for the horticulturist.

With a summer so favorable for growth and the dry fall inducing well ripened wood, plants of all kinds entered the winter in good condition and we hope for better results next year.

The SECRETARY: There is a report of the committee for the selection of judges who will be available for agricultural societies so that they might communicate with this Association for names. This report is not sufficiently matured for publication.

The PRESIDENT: When we adjourned yesterday afternoon it was announced that the important subject of our export trade in apples and other fruits would be taken up this morning. Mr. Shuttleworth is here, and I will now ask him to introduce the subject.

Mr. SHUTTLEWORTH: In dealing with the fruit I have always thought that the allied interests of the grower and the handler of the fruit could not be divested of mutual confidence. We cannot very satisfactorily take the place of both buyer and grower. We cannot here as growers act as sellers. Our interests as growers are such that they demand our personal attention; therefore there has to be some intermediary. There has to be a middleman; possibly he is a necessary evil. I probably represent one of those evils. I am here to define my position. I think, on the whole, we have enough honorable men in business who can be trusted to handle the interests of those who produce. I don't say that all men in business are honest, nor do I say that all growers are honest either. My experience extends over twenty years, since the time when, as a boy, I could look into the barrel, almost, I packed apples. I have handled them and watched them from beginning to end, and my experience many times has been bought very dear. I find that we have honest men and dishonest men in both departments. We ought to have mutual confidence if we are going to do business. I don't believe it is practical for our growers to be distributors of their products in the foreign markets, especially because they cannot be here to grow it and there to sell it at the same time; so we have to have an intermediary. The first thing we must understand is what is the consumer's demand. It is no use trying to force upon consumers, who are the buyers of apples, an article they don't want. It is pretty uphill work to give them a good article after they have been running in a rut, particularly the English consumer. He is not very apt to take on new varieties and say he likes them better than those he has had long experience with. If they ask for a Spy grow them a Spy; if they ask for a Ben Davis grow them a Ben Davis. We have made mistakes as growers in that we have tried to put upon the market an article that is not really required. You should understand the whole of the conditions that exist. I believe it has gone out in one of your reports that the Ben Davis is one of the best exporting apples. I say intrinsically the Ben Davis is nowhere, and as soon as the demand for that variety of apple is supplied then the surplus supply will have to be slaughtered. The Ben Davis is almost entirely used for show purposes. It is an apple that is not good enough to rot very easily. (Laughter). I won't say anything about the Missouri or Kansas Ben Davis—I believe that they are better than our Ben Davis; but to recommend the production of an apple which can only be used for show purposes would be a mistake—not that we will feel it so much as those that follow us will. The Spy is a superior apple intrinsically. It may not be so heavy in its yield, and it may not come into production so early, but it is an apple that will command a price and eventually drive all the other apples out of the market—the Pewaukee, for instance, which is not a good apple. We must take into account the fact that in European countries they are producing a better article every year. They are not asleep any more than we are. They are just as cute and just as shrewd and looking as far ahead as we are, and every year they are producing a better article and putting it up in a better shape. Last year we had twenty Frenchmen come over to examine the American packages to know how it was done and see the advantages of it; and they found that out. I believe, this year, they obtained our barrels, or barrels made in the same way, and put their apples upon the market exactly as we put ours upon the market. They are close to the market and they are also growing a good quality of fruit. I don't mean to say that their apples are as good as ours. I believe that we have some varieties of apples that are superior to anything grown in the world. I don't believe that they can produce the like of our Northern Spy anywhere—not in Denmark, where they produce good apples, or in Belgium or in Northern Germany. I have not seen any apples coming equal to our Northern Spys. As an illustration, I would ask if you had two barrels of apples, one a barrel of Ben Davis or Pewaukees and the other a barrel of Spys, and you had a family of boys and let them have free access to these barrels, how long do you suppose your boys would be in finding out which were the best apple? Now, if you think that the English consumer, who is willing to pay a good price for a good article, is not as capable of judging as your boy is, you make a grand mistake. I believe that we can produce the best varieties, and I don't think that we should look for immediate return. I believe we must look

for ultimate returns if we want to keep this trade, which is an important one We produce more than we can consume ourselves, and our American friends don't want our apples except our Spys, and now and then when they have a failure in a crop of other apples, but they are always asking for Spys, no matter how large their crop is; we all know from experience that the American demand is large for our Spys, and they will pay a good price for them. The Spys are worthy of it, and will, I think, meet a growing demand both there and also in Europe. Spys have not been quoted and sold as high this year as Baldwins in Great Britain, for the reason that most of the Baldwins that have been going forward have been very highly colored. The Baldwin is a better known apple than the Spy amongst the general public there, but the Spy is working its way up to the top and will stand where it deserves to stand, at the top, its intrinsic value being away ahead. The Newton Pippin from the Hudson Valley is the only apple that can compete with it; it is crisp and juicy and holds its flavor longer than any apple that I have seen. I have seen Spys in May and June that were as crisp and juicy as at any other time of the year and when other apples had lost all their flavor. With regard to the grading of apples, I contend, and have all along contended with our exporters of apples, that the proper way to do was to grade them No. 1 and No. 2 and sell them as such, and if they are not No. 1 the man who puts them up should be punished if it is possible to punish him. (Hear, hear). I say we make a mistake in trying to defraud the consuming population of Great Britain; we are only hurting ourselves ultimately as well as doing a wrong. A man who systematically defrauds the consumer over there will find that it does not take him long to wreck himself. They will look with suspicion whenever that man's brand is on the barrel if they have once been cheated, and I don't blame them for doing it. Very often I have been ashamed myself to see a packer with a good reputation destroyed because he has bought indiscriminately, and possibly he may have allowed his own men to put up fruit fraudulently, that is, they are falsely packed. I don't say but what we have plenty of men in the trade that pack honestly, and are getting the best market prices for their fruit. I believe the majority of our exporters agree with me, and will be quite satisfied that the apples should be graded No. 1 and No. 2 and sold as such. There is no need of any other way of going about it at all. Let the apples be sold as No. 1 or No. 2 and they will bring their prices. We have people there who are buyers of No. 2 fruit. The vast consuming population throughout Lancashire and Yorkshire have not the money to spend that people have in other places, and they will take a No. 2 apple and pay what it is worth. If we produce only No. 2 fruit we should expect only No. 2 prices. Now as to packages Barrels seem to be, as far as I have seen, the only package in which we can ship apples to advantage. Packages have been tried from all points—from Lisbon, from France, from Belgium, from Denmark, and even from Tasmania. I think you will find boxes as a rule too expensive; I don't know what Mr. Woolverton's boxes cost him.

Mr. WOOLVERTON: Twelve dollars a hundred.

Mr. SHUTTLEWORTH: They hold about a bushel, that is thirty-six cents for three bushels, the cost of the barrel; what is the cost of the paper?

Mr. WOOLVERTON: Seven or eight cents a box, perhaps ten.

Mr. SHUTTLEWORTH: That makes it expensive.

Mr. WOOLVERTON: Then there is the expense of wrapping, probably about four cents a box.

Mr. SHUTTLEWORTH: That adds very materially to the expense. I believe myself that if we could keep the quality of our fruit extra superior, that that expense would be compensated by the increase of the price that we might obtain for fruit on the other side. However, if they all go into it, it will have its levelling effect. The barrel seems to me to be the most convenient package to handle fruit in. We have not seen anything that would take its place, taking cost into account. As exporters of fruit we must try, if possible, to reduce the cost of the fruit laid down in consuming markets; that should be one of our principal aims. In packing apples we know that it is necessary to press those apples. A good many of our apples are partially, if not wholly, destroyed by the pressure necessary to keep them in their places, that is in holding them down. The barrel is rolled;

if it is not tight and solid these apples will roll and bruise themselves until they come to be discolored with the rolling that they have had, therefore the barrels must necessarily be packed tightly so that they will hold without any movement at all of the fruit. That in itself destroys or disfigures a large number of apples, particularly adjoining the pressed end of the barrel. We have tried to overcome that. We have tried excelsior from Nova Scotia, and sometimes when the apple was decayed this excelsior got mixed up through the fruit, or sometimes when the fruit sweated, as it will sweat in barrels, this excelsior broke up first when it was dry and brittle and settled down through the barrels and this sweating made it adhere to the apples, and when they were turned out nearly every apple had to be rubbed off before it presented anything like a decent marketable appearance. We tried putting in paper heads, that is, I had some heads made about a quarter of an inch thick from paper pulp. These I got from Maine, and we had these put in barrels so as to prevent the necessity of too heavy pressure, and as the fruit shrunk or any of them decayed the paper itself would gradually press out again and hold the fruit in its place, thereby saving some of that loss which is necessarily entailed when the apples are pressed in without any heads. However, I have not found anything that I think is really practical. Paper boxes, that is, paper pulp boxes made with round edges, that is, pressed in squares, possibly will take the place, but I don't think we have yet got to that point where we can produce a paper box which will enable us to lay the apples down at the least possible expense in the Old Country—the box will cost too much money, something the same as our wooden boxes. We want to get a package which we will be able to sell there for some other purpose if we can. Second-hand barrels with the heads on, sell at about sixpence each, and that in a measure is taken into account when a man is buying the barrels—he knows when he turns out the barrel he can get sixpence for it. Then again, in the shipping of our apples there are faults in handling by the transportation companies. Apples are not handled very often as they ought to be handled. We have fought against them on this side and on the other side, claiming that they have not the right to handle the fruit in the way it was handled. I believe that now, through constant contention and striving with them, our steamship people are doing better than they have ever done before. I have myself stood on the bottom of a gangway and defied them to let the fruit down, so long as I stood there, in the way they were letting them down. They were letting a barrel slide down twenty-five feet, and I have seen them go down with a chuck that would burst the heads right out. After having a meeting of shipowners we have shown them that their interests as well as our interests and those of the producers on this side were intimately connected, and that they could not destroy the fruit in that way without injuring themselves; and we all know that the nearest way to get at a man's care of anything that we have to entrust to him is to get at him through his pocket. (Hear, hear.) He is more apt to respond to anything that is in his interest. I believe the steamship company now feel that, and in the last five or six years our trade has been handled better than ever before, and I believe that they will do anything in reason. That they will give us special space I cannot expect, because our export trade is of such short life that they cannot afford to put upon the route steamers fitted up for our trade. You could not ask them to do that; it is too expensive to run a steamer for three months and lay it up for the other part of the year. If anyone has an interest in steamers he will know how expensive it is and we cannot ask them unreasonable things. I would, however, ask and do ask that they would not put our fruit into a vessel which is unsuitable for carrying fruit. Many steamers have gone out with ten or fifteen thousand barrels of apples that have not capacity for more than seven. I have lost thousands of dollars for that reason, but the fruit was there and had to go some way, for we were afraid of frost at this end and our time was limited. In regard to the hope of putting on the English market our grapes, pears and plums, I would say at present I do not believe we can produce a grape that is going to meet with the requirements of the British public. They want a meaty grape, with less seed, and a grape that they can masticate. They bite their grapes and chew them; they masticate their food They are not satisfied to swallow pits and pulp all in a lump. There are peculiar flavors about our grapes, so that it seems the taste has to be educated. We have grapes there that come from Lisbon and parts of France which meet the require-

ments of the consuming population there, and I don't think that we are doing right to expect to make a success of our exporting grapes until we can produce an article that they want. I have spent money in trying it. I was prejudiced in favor of our own grapes and wanted to see the trade developed. I didn't ask anyone or the Government to stand by me; I tried it in my own interests. I thought if we could only get them to use our grapes there was money in it; however, I didn't make a success of it. Pears are produced in France and some parts of Belgium and Germany equal to ours; they are close to the market, and except in years like this where the crop is a failure I hardly think that we can hope to open up a very large trade. In tomatoes the sources of supply are widening every year. You may think it is strange, but across from Liverpool, in Cheshire, they are producing as fine tomatoes possibly as we are producing in any part of Canada. I have seen them right there. I will not say that they will produce them every year as good. We do not produce as good tomatoes and peaches here every year. However, in the island of Jersey they are producing as fine tomatoes every year as can be grown under the sun, both in flavor and appearance, and they have been coming into England in large quantities and have sold heretofore as high as sixpense, eightpence and tenpence a pound readily. They are producing larger quantities because it pays them, and the price is receding every year. The tomatoes they are getting from Spain are not as good as those that we grow here, nor are they as good as those grown in France, but they are getting what they call an English seedling, which is a very bright red tomato, and the stem is green. I do not know the names of the different varieties of tomatoes, not being closely connected with the growth, but it is a smooth tomato and perfectly red, and in flavor equal to anything I have ever tasted. I do not want to throw a pail of cold water over any scheme we have for increasing our trade, but I do not think there is much use of spending money upon a business which is not likely to be lucrative Of course I do not mean to say that you cannot produce grapes that will meet the demand there; I believe you will. I do not mean to say that all you intelligent fruit growers are going to sit down and say that you have accomplished what you have set out to do. I believe you will grow better fruit. I believe we will market and grade it in better shape, and I believe ultimately we may get better grapes there, and possibly will supply the market requirements there. In plums I don't know very much whether it would be possible to expect a large trade there. They are producing in Belgium and Germany large quantities of plums, and the peasantry, *i.e.*, the small fruit farmers, are going more into it year after year. The same in Kent and Essex and Worcester, in England. They are producing larger quantities year after year, and the demand, which is increasing by leaps and bounds there in fruit, is being largely supplied by home production. I think they can grow very good plums there. I have seen just as good plums there as I have seen anywhere, that is where they are grown in the south in Essex and Kent and down through Worcester; they grow them to perfection, I think, there.

The SECRETARY: If they are a very low price here do you not think it might pay to send them over?

Mr. SHUTTLEWORTH: Most of our fruits of that kind are bought for preserving. I will give you an instance of the quantity of fruit that is put up by some of the large firms. We think nothing of selling forty and fifty and sixty tons at a time to Crosse & Blackwell. I have seen us when we have had sixty and eighty tons of plums—and I have sent the whole lot in one day to one man, W. H. Hartley, just outside of Liverpool. He has a capacity of putting up 112 tons of jam a day. He draws his supplies largely from the continent, that is for certain varieties, and the rest he gets in England. They are producing to meet that demand, and we think nothing of taking an order from him of possibly ten or fifteen thousand cases of Salonne oranges. He will bring in a ship to take care of them, and you can understand that they are not behind the times so much as we imagine. They are meeting this demand largely by home production; they are increasing the home products. Germany and the other countries finally, I believe, will be driven out of the British market in a measure, owing to these home productions. They are going into the lowering of freights, that is, discriminating freights. We have, and so have the continental countries, advantages granted by the railway companies of Great

Britain which have not been granted to the home producers. It is an evil. They see this evil and they are going to remedy it; that means that they are going to send their fruit from the Midland counties to those different points in the same district much cheaper than they have ever done before. Much land that has been under cultivation for grain will go under cultivation for small fruits. I don't think we will ever see them compete with us in apples. France will compete with us in pears, plums and strawberries and berries of all sorts—I think we can do very little with them. Until we can produce a better article in pears I don't think it will be wise for us to spend too much money in our experiments. We have tried it, and it has been a failure. Peaches are grown in France and come over there in very good condition, put up in small packages of about twenty-four—some twelve and some twenty-four—flat boxes. However, I think there is something that we could possibly do something with if we could get our fruit on to the steamer in time Delaware may drive us out of that; Delaware produces a good peach, and they are close to the seaboard, and can get them on the fast steamers.

The PRESIDENT: What about California shipments of fruit there?

Mr. SHUTTLEWORTH: California fruit comes in after our English is pretty well over, and it meets only a limited demand. I don't believe California fruit will make a success there. I believe they are producing fruit over there which is far superior to California fruit. I believe we produce here a better pear than any California pear I have ever tasted. (Hear, hear.) I believe they are producing to-day in Lisbon a better grape than they produce in California. I have tasted grapes in California; they may be better there than here; but when we put them on the English market in comparison with the Lisbon grape I prefer the latter. Then again they are opening trade with the Cape. My people wanted me to go there two or three years since to look after the English grapes that grow there. They produce an excellent grape, very much in flavor similar to some hothouse grapes of Hamburg particularly. This is a wide subject. I believe I will have your sympathy in the matter of my position so far as defending myself as a shipper. (Hear, hear.) I do not think and never have thought that our interests as shippers and growers are antagonistic. I believe it is necessary that we should have both the confidence of the growers and shippers, and that they should have our confidence. I believe by working in harmony with each other we can make a success of certain lines. I think it is false policy to endeavor to build up a trade which is not likely to assume any proportions.

Mr. PARKER: What about the shipping qualities of the Spy?

Mr. SHUTTLEWORTH: It is one of the best qualities. There is another apple that we do not give enough prominence to, and I think we ought, and that is the Greening. I think in time, when we get better shipping facilities, that we will get the Greening in better shape on the English market than ever before. The apples will not scald. Our Greenings from Canada keep very much better. You must remember that those quotations given by Mr. Woolverton are New York barrels, or pony barrels, as they are called. Our barrels are full barrels, and we try to get our American friends over there to use full barrels and have a uniformity of package. I think that ought to be striven for all through. It is not only better for the growers of apples, who know what they are selling, but for the buyer, who knows what he is buying. They are more easily tempted, I might say, to buy a package that they know something about than a package they don't know anything about. It seems a small thing, but when you come to sell it, it is a very important thing. It is a very difficult thing for me to explain to a man that a package is a square package, but it holds the same as a barrel.

The SECRETARY: Do you know what the legal capacity of a barrel is?

Mr. SHUTTLEWORTH: I think it is three bushels.

The SECRETARY: I don't think it is so much; it measures twenty-seven from chime to chime.

The SECRETARY: I want to introduce a little resolution which will, perhaps, shape the debate, or at least bring to a focus one point in the discussion. I am very glad to hear this admirable address from my friend, Mr. Shuttleworth. We had an idea, some of us, that there was a little friction of feeling between apple buyers and apple growers,

but I do not think that in anything we have heard this morning there is anything to cause friction at all. We find that to a great extent our interests are one. The point I wish to make is with regard to the amending of the Act that was passed by the Department of Agriculture last spring, which left out altogether the regulating of grades. Now Mr. Shuttleworth has told us this morning that he, as representing the buyer and shipper, would like to have these grades attended to and observed, and we as growers feel that it is a very important point also; so I would like to move:

"That this Association believe it to be desirable that an amendment be made to the Act for the Prevention of Fraud in the Sale of Fruit, providing for the definition of grade 1 and grade 2, in order to facilitate trade."

Mr. McNeill: I will second the motion, and would like to make a remark in relation to this address we have just listened to—one of the most valuable we have had during the sessions here, and well worth staying another day to listen to. (Hear, hear). I would also ask that we qualify any remarks that may have been made—remarks that must receive great weight when they are within our line of business, but should not have the same weight when we touch lines with which we are not perfectly familiar. I wish to make one correction. After studying the matter for years I state as my deliberate opinion that if the fruit trade in this country were regulated in varieties by the opinion of fruit experts, the trade would be nothing. Take for instance the Concord grape. When I was about setting out my orchard I had the opinion of a director of this Institute, and when I mentioned the Concord he said, "Yes a few Concords might go in!" Why, if it were not for the Concord grape I would not be in the grape trade. The grape industry in this country would shrink seventy-five per cent if the Concord grape were taken out of it, and yet the expert would hardly recommend me to plant so poor a variety of grape. The same with plums. What is the mainstay of the plum trade in this country? The Lombard, one of the poorest plums. So with apples. If we were confined to the Northern Spy the people of this country would have no orchards at all for commercial purposes. We may as well recognise that; and do not let it go out among the people who have not too much money to spend that it is the opinion of this Association that they should plant the Northern Spy. I grant it is a fine apple, and if I had my family in the position in which I wanted them I would give them the Northern Spy and nothing else if they wanted it; but it is almost impossible to grow Northern Spy apples in sufficient quantity to make it a successful commercial venture. There are two elements: The quality and the commercial backing. Let us be particular that these varieties that we recommend are those that can be grown in a commercial orchard for commercial purposes and for a long series.

Mr. Pettit: The Legislature has regulated that question, I think, to the satisfaction of the fruit growers of this country as nearly as can be done. What a first-class barrel shall contain is specified in the Dominion Act and that was passed with a view of shipments to foreign countries. In the local Act it is required that the face of an apple package shall fairly represent its contents. I do think that to go and hedge about the fruit growers in this country along the lines of specifying distinctly what they should do is putting simply a block in their way and hindering the good work that we want to encourage in this country. (Hear, hear). I believe that as far as our shipments to the Old Country go we should try and work strictly under the Act for that purpose, and if possible raise the standard of quality and packing and condition of the Canadian apples in the British market to the highest point that it is possible for us to do. I question whether it will ever pay us to ship second-class stuff to the British market. I want to reply to Mr. Shuttleworth; he has taken the stand as one representing the views of apple buyers and handlers of fruit in the British market. With his great knowledge of the situation of affairs in the British market he has given us from their standpoint his views. We remember he is a Canadian like ourselves, engaged in the same business, but he has got imbued with the sentiments, I believe, that are strong in the foreign countries. Now we had a little comic song the other night telling about the poor fellow who "Couldn't change it." This is one of the things that I do believe we can change. What is the position in which we find the fruit growers in this country to-day? I find them not acquainted with the shipment of apples to the British market. They are not posted as

to what firms in Britain are reliable and good firms to ship to. They really don't know what they are going to do with their apple crop. It is too large to put in their cellars or to trust to their local market consumption; the time is short; the apple buyer comes around—I have been one—and he says, "I cannot give you more than so much for apples;" the farmer replies, "Well, you don't get out of this yard till you have them, because I don't want them to freeze or spoil on my hands," and he sells them at whatever price the buyer sees fit to give Mr. Shuttleworth referred to the honesty of the commission men in the British market. Now, I have not a word to say about their honesty at all. I have shipped to them for years and years, and always come out very satisfactorily indeed—not, indeed, with a very large margin of profit, but without sinking any money. I believe they are just as honest as any other class of men, but I believe that their style of doing business is not in the interests of the fruit growers of this country. Now I will venture to say there is in this room many a man who has a brother, sister, father or mother who is living in England to-day and who has written about Canadian apples, and I will venture to say that you cannot show me one that has bought a good barrel of Canadian apples to put in his cellar or his house for use at very much less than six or seven dollars a barrel. I have had it from a dozen of them. Now, our apples are sold there at about twelve shillings on the average; that would represent in round numbers three dollars a barrel. Now, how in the world does the consumer pay so much and the producer get so little? The transportation company gets a dollar and a little more; I hope the buyer gets a little of it, he deserves it even if he is something in the road, as we call him. But the other part I don't know where it goes, unless to the fellow who rolls the barrel on the waggon, and another part for drawing it, and another for rolling it off again, and another for taking the empty barrel away and burning it and clearing up the rubbish. In the best interests of the grower I think we ought to get out of that rut if we can. I claim that the closer we come in touch with the consumer of any country the better off we are. The nearer our market is to our door the better it is for us, and when we get our growers to take hold of this matter and pack their apples, I hope by that time we will be able to ask the Government to fill the gap that is now vacant by an inspector and ask him to inspect at the point of shipment and brand them just as they are—not that we are going to make it compulsory for our growers to have their apples inspected, but to give those who want their apples inspected a brand that will introduce them into the British market. I hope our Government will do something on the line that they are going to do with the dead meat trade, that is, that they will have emporiums throughout the land where Canadian meat will be represented and sold as Canadian meat. And when the product gets directly in that way to the consumer we will get better results than we get to-day. In regard to the Englishman not liking our grapes I think Mr. Shuttleworth needs an answer. Grapes are a product that we are growing immense quantities of, and we are prepared to put them on any market at a low price and yet one that will be satisfactory to the producer in this country. When Englishmen come to this country—and I have met many of them—they do enjoy our grapes, and I venture to say that if there is a Canadian that can put away more of them than an Englishman does when he comes here, he is a pretty good specimen. (Laughter and applause). I say we will put them in the British market so cheap that the poor man and his family can indulge in that luxury which to-day he dare not touch. Take another point—our Canadian tomato—I don't believe there is a country in the world that can produce a tomato equal to that grown in the Province of Ontario.

Mr. BOULTER: That is so.

Mr. PETTIT: What is the price of those in the British market—two, four, six and seven pence a pound. What do they run in Canada? One-half cent a pound.

Mr. MCNEILL: One-quarter cent a pound.

Mr. PETTIT: Give them a half cent.

Mr. MCNEILL: I will contract to sell anyone here for twenty cents a bushel, I don't care how many carloads you take.

Mr. PETTIT: Half a cent a pound for Canadian tomatoes in our market is about the average price they are bringing to-day, and I have quoted you the price in the British market

and I am satisfied we can land them in London, Liverpool or Glasgow at a cent a pound or a cent and a quarter at the very most, and if we can put them there we want to put them where the poor man can eat them, and we will make him and his family healthy and appreciate the luxuries that this fair land can produce. (Hear, hear.) That is the way we are going to claim that market. That is the way we are going to educate the Englishmen. We have been educating him along the line of that apple, the Ben Davis, and I am sorry to say our Secretary has been trying to educate him along another line with that Cranberry Pippin. (Laughter.) We are going to send him something better than that. A little while ago he said, "I don t want anything but a red apple" I often wondered why he wanted it red, but a fellow told me when he came from the Old Country, "that they can polish them up so nice on the street corners that they can sell a great many by that process." (Laughter.) They did nibble away at the Ben Davis a while. They did not like the Rhode Island Greening because it was of a dark green color. To-day the Englishman likes to get a Canadian Greening just as well as we do, and he finds it one of the most valuable for cooking, for dessert, or for any other use that he desires to put it to, and we are going to go on educating him along that line. Mr. Shuttleworth refers to certain other countries being able to raise products that will crowd us out. There is not one of those countries in ten that produces at the season we do, therefore we are going to come in at the opening and fill them up to the handle. (Laughter.) We have in this country the people, the energy, the "pluck and plod," as the Hon. Mr. Dryden said yesterday. We have gone into that market with our cheese and have stayed there, and to-day we are claiming the cheese market. (Hear, hear.) We have gone into that market with butter, and I believe the day is coming when the pluck of Canadian people will drive the Danish butter to one side and claim the market for us. I believe the same in regard to our Canadian apples and fruits, when we put ourselves in a position to force our way into those large centres of trade in the old country—not only in England but every country where we can drive the wedge in—for we know that when we do drive it in we are going to give them something that is good and wholesome and to their best interests. I say that is what we are going to do—to wedge our way in and educate the people and do as we are not doing to-day, send thousands and thousands of shipments to those markets in the near future. How are we going to prolong this market? I believe we are going to occupy that market from October almost to the following October by a system of cold storage, where we will send them forward in their season such apples as are ripe and in perfect condition for use, and place them on that market and sell them. We will begin October and send varieties in succession, until the Canadian Spy goes into the market, and with them we will feed them right up to the fresh apples again. Speaking of the Canadian Spy I say that if that apple is grown perfectly and in good condition we have a great market for it, not only in Great Britain but to the south of us to feed our neighbors when their apples are gone. (Hear, hear.) They live in a warmer climate than ours; their apples will not keep like ours; the farther north the better the quality and the longer the keeper; and instead of giving them our money for bananas or other fruits that our people like to feed on, we are going to give them our apples to the extent of millions of barrels.

Mr. J. W. Smith, of Winona: I would like to ask Mr. Shuttleworth if he thinks the Kiefer pear will ever take in the English market? That is an important question because we can grow enormous quantities of that variety.

Mr. Shuttleworth: I don't know enough of the Kiefer pear in its keeping qualities as a shipper to satisfactorily answer that question. I have not seen it tried sufficiently There are a great many fruits that we grow here that are all right for the home market that do not stand shipping. May I say in answer to Mr. Pettit that Canadian fruit comes into the English market at the same time that we get fruits from other countries; our Canadian pears and apples come in the same time as the French and German pears and apples; and when the bulk of our apples are consumed we are getting fresh apples from Tasmania and then from Lisbon and so on north, so that we have apples the year round.

Mr. Caston: What time does the Tasmanian apple reach England?

Mr. Shuttleworth: In April.

Mr. SCHELL (Woodstock): I shipped a good many Kings, and they did not bring us very much above the Spys, simply because the quantity of them was larger than in other years. In regard to the question of grading No. 1 and No. 2, I tried that and I do not think you could get a more difficult thing to handle than that. You send a gang of men into the orchard and tell them what you think are No. 1, and perhaps in that same orchard two trees are standing right side by side of the same kind and there is such a difference that some people would not believe they were the same kind, and yet they are perfect, there is nothing wrong with them. Now, how are you going to grade them? They are both perfect, and perhaps there is a little difference in the color or there may be a slight difference in the size. If you send out over a dozen gangs of men and tell them to grade them No. 1 and No. 2, there is hardly a gang that will grade those apples the same as another gang. What one gang will say are No. 1 apples the other gang will say are No. 2. If you ship No. 2 you will lose money every time.

The SECRETARY: According to your own statement you do not know what is meant by grades 1 and 2.

Mr. CASTON: Is there not a class of apples too good for culls and not fit to go into first-class barrels?

Mr. SCHELL: That is one of the difficulties of grading apples. That is the trouble of getting farmers to pack their apples. They give themselves the benefit of the doubt, and in they go. (Laughter.)

Mr. RICE: As to packing your own apples in your own orchard, I am not only a Michigan man, but I came from the great apple-growing region of Wayne county, New York, where we had to pack apples by the million barrels; and had we waited for the buyers to come into our orchard and pack our apples we would have been at least three or four years behind. (Laughter.) Now there are things that work themselves out if you just allow them to do so. In selling our apples the buyers knew that we were producers, and the buyers were always there in competition. There was not simply the one buyer, as Mr. Pettit said, to whom the farmer would sell at any price, but before one buyer got out of sight the other was in sight, and the first one that came was sure to come again, and so we had a chance to pick our buyers. We picked our own apples in every case, but when they were sent into the market the heads were taken off and if they found one barrel that was suspicious, very quickly the whole lot was considered as under suspicion, and very likely that man was required to put his barrels in one corner and go to work and re-sort them. He knew he would get caught the next time he came in with his load, so he brought in his apples in right shape, and in all our apples I never yet heard of an instance where a buyer had purchased apples and paid for them that he ever went back on the seller for damages. He examined the article when he came into the storehouse and there accepted it and paid for it, and the man went home. They knew the packers and the character of the packing from experience, and governed themselves accordingly as to watching them. In this way this matter often works itself out and does not require any paternalism by the Government. In regard to the pony barrel, our Legislature passed a law that one hundred quarts should represent a barrel, and that made the pony barrel, but most producers preferred to put in a peck more and have common barrels rather than have their apples go out in pony barrels. That gives us trouble all the time. The pony barrel is the snare to buyers in foreign markets everywhere, and we are sorry for it. That is working itself out, too. I do not think it needs any legislative action to prevent that. If you can grow the Northern Spy you have the world as your market. (Hear, hear.) At our last Horticultural Society meeting a great many noted men were present, and the question was asked, what will we advise our people to plant? Some said Northern Spy. President Morrill, of Benton Harbor, said: "Will you put that curse upon a young and inexperienced man who asks you innocently for advice what to do? Will you tell him to plant a thing that you know he will never take one dollar out of above his expenses?" (Hear, hear.) Professor Bailey said: "I would not recommend the planting of it, not because of the quality of the apple but because your expenses will count up far beyond what you will ever take out of it." That is the experience we have had in our country with it. Now, if you can make money out

of that apple, plant your whole country with Northern Spys and you cannot make any mistake. We cannot make any money out of it. I have no words in favor of the Ben Davis. It comes right into the market when it is met by your Fameuse, and if you can grow the Mackintosh Red as I have seen the samples here to-day—we cannot grow it without the scab—you meet the Ben Davis with the Fameuse and the Mackintosh Red, and we stand no sort of a show. You grow Ben Davis not to sell against the Fameuse and the Mackintosh Red ; you grow it for next year's market, and the idea of putting it on the market when better apples are being sold is perfectly outrageous. (Hear, hear.) Don't send your Ben Davis off to be examined and sold at auction when good apples are being sold. Let people grow Ben Davis, selling them if they have a mind to ; they won't hurt you as long as you can put in your Greenings. While Ben Davis are being sold at $1.75 men are trying to find some Canadian Greenings and are willing to pay $3.75 a barrel for them.

Mr. SHUTTLEWORTH : I think the best Ben Davis have come from Southern Illinois this year.

Mr. PETTIT : Nebraska will knock them out.

Mr. MCNEILL : A very large dealer in Detroit said they got them from Missouri.

Mr. RICE : Mr. Augustine, in Illinois, has planted 40,000 Ben Davis apple trees and calculates to supply the world. They calculate they will build a special line of railway to the seaboard and have a special line of steamers to carry them into the foreign market. (Laughter.)

Mr. RACE : If you were planting trees for your children you would certainly recommend planting the Spy?

Mr. RICE : No, sir, I would not, because I want my children to have apples. (Laughter.)

Mr. BOULTER : If you were living in Canada would you advise planting Northern Spys?

Mr. RICE : Taking the Canadian evidence for it that it is bearing well.

Mr. BOULTER : Did I understand you to say that your locality has given up growing them ?

Mr. RICE : No ; I say they do not bear well there, and there has never been a dollar taken out over and above expenses. A man went down to Canada and bought a carload of Golden Russets, Northern Spys, Tolman Sweets and several other varieties —Baldwins, I think, a few ; he sold them right out at $3 a barrel without any difficulty whatever at the same time that the Ben Davis was being sold at $1.75. As to the quality of those Tolman Sweets, we never saw anything grown in our vicinity that equalled them at all. I looked over the Greenings and there was not a worm-hole anywhere on them. The Greenings in western New York even have worm-holes. Now there are more varieties than simply the Northern Spy that will bring you good prices if you grow them. (Hear, hear.) It was stated at our Horticultural Society meeting that the Baldwin is no longer worth planting. The time was that it was said that if a man had a thousand trees to plant he should plant 999 Baldwins and then go and get a Baldwin to finish up with ; and those same orchards have had to be cut down because they are not bearing, and the Baldwin is going out of bearing throughout our whole country. If you can grow them you can send them the world over.

Mr. MCNEILL . It grows here well yet.

Mr. RICE : If the Baldwin grows well with you, go ahead with it ; but, if you have an apple that does not bear, what is the use of planting out an orchard that has no profit in it? So we are not recommending the Baldwin in Michigan any more. The trees are so affected by scab that we have to drop it out.

Mr. CASTON : In our sections we have a large class of beautiful fall apples. They come to great excellence and perfection of size and beauty, and many are of very good quality. Now, if we could get a market for these apples, there is more money in them

than in any kind we can grow, because they produce fruit almost as soon as they are put out. Take the Wealthy, for instance, there is more money in that apple than in our winter apples. We have a large number of Wealthys which are practically wasted because we cannot get them to the market. We owe a debt of gratitude to those gentlemen of the Niagara Peninsula who have contributed the fruit to this trial shipment. From what I can hear they are likely to lose that fruit entirely. They have made that sacrifice, and it was for the public interest, and I say it is nothing but right that we should recognize it as fruit growers. They are prepared to do further in that line, but I hope they will not be subjected to any loss in their worthy and laudable efforts to secure a market for our fruits in the Old Country or anywhere else in the world.

Mr. PETTIT: We will lose it again if necessary, but we intend to break the ice. (Hear, hear.)

The SECRETARY: It was simply to define what grade 1 and grade 2 means that I made that resolution. I do not wish to press it upon anybody unless they choose to use that mark. Even for the Toronto market, if I agree to buy a barrel of No. 1 apples and have a dispute about the quality, I should like to have some way of appealing to know what grade 1 means, and I think it should be defined in the Provincial Act. However, the time is now so far gone that we cannot debate the question longer, and, with the permission of Mr. McNeill, we will lay it over and take it up at some future time.

Mr. G. R. PATTULLO read the report of the Committee on Resolutions and moved its adoption. The motion was seconded by Mr. Smith and carried amid applause.

REPORT OF THE RESOLUTION COMMITTEE.

Your committee beg to report as follows:

That the thanks of this Association be cordially tendered to the Woodstock Horticultural Society for the ample and satisfactory arrangements made by them for the holding of this Convention, which has proved to be one of the most interesting and successful in the history of the Association.

To the mayor and corporation for the cordial welcome extended to us and the opportunities offered to see the manufacturing industries, the educational institutions, and the many comfortable homes of this beautiful and prosperous town.

To the Principal and faculty of Woodstock College for the pleasure of a visit to that Institution, and for the generous hospitality enjoyed there.

To the ladies and gentlemen who have so kindly contributed their musical efforts at the public meetings on Wednesday and Thursday evenings.

To Messrs. L. B. Rice and L. D. Watkins, our visiting comrades in the great work of horticultural development, who have been with us as representatives from the great State of Michigan, and Mr. T. Greiner.

To Professors Saunders and Craig, from the Ottawa Central Farm, and Dr. Mills, from the Ontario Farm at Guelph, all of whom have greatly contributed to the interest and profit of this Convention.

To the Hon. John Dryden, Minister of Agriculture for Ontario, for his presence, practical sympathy, and valuable addresses at the Convention.

To the Woodstock press, the Toronto press, and the Associated Press for the specially full and satisfactory reports that have been given of the proceedings of the Convention, and the interest that they have thus shown in the work of this Association.

All of which is respectfully submitted.

W. M. ORR,
A. M. SMITH,
GEO. R. PATTULLO, } Committee.

Mr. PARKER thanked the Association for the kind manner in which they had acknowledged the efforts of the local society, and expressed his disappointment that a larger number of people did not turn out to the evening meeting.

Mr. WATKINS thanked the Association for the gentlemanly manner in which the delegates had been treated, and hoped that his society would always be in close touch with this one, and that there would be reciprocity all the way round.

The meeting closed at twelve o'clock noon.

APPENDIX.

REPORTS FROM AFFILIATED HORTICULTURAL SOCIETIES.

BURLINGTON.

At the annual meeting of the Society held December 17th, 1895, the following officers were selected for the year 1896:

President.—Geo. E. Fisher, Freeman.

Vice-President.—J. S. Freeman, Freeman.

Secretary-Treasurer.—A. W. Peart, Freeman.

Assistant-Secretary.—Geo. N. Peer, Freeman.

Directors.—Apples, Edwin Peart; Grapes, D. Jardine; Small Fruits, Joseph Gardiner; Pears, W. V. Hopkins; Peaches, John Ireland; Plums, W. F. W. Fisher; Cherries, T. Foster; Vegetables, J. W. Bridgeman; Shipping, Joseph Lindley, J. S. Freeman and O. T. Springer.

Auditors.—Fred Parsons and William Emerson.

Executive Committee.—Dr. Husband, Alex. Riach and T. Glover.

Reports on the various departments of fruits were made by the following gentlemen:

Geo. E. Fisher on "Apples;" A. W. Peart, "Grapes;" J. W. Bridgeman and Joseph Gardiner, "Small Fruits;" W. V. Hopkins, "Pears;" Alex. Riach, Peaches;" W. F. W. Fisher, "Plums;" J. S. Freeman, "Cherries and Shipping."

The Secretary-Treasurer presented his annual report which showed an increase of membership for the year, and a substantial balance on hand.

The President, Geo. E. Fisher, in his annual address referred to the steady growth of the Association, and the necessity for each member to work zealously for its good to the mutual profit of all. We should be ready at all times to modify our plans according to the changing conditions, adopt business-like methods, and be on the alert for the best markets. The fruit grower of to-day should be educated and understand the principles of botany, chemistry and pathology as applied to the production of fruits. He endorsed the scheme of local experimental fruit stations, as they would save both time and money. While fruit growing is one of the great industries of this province, we must pay strict attention to the quality of our fruit as outside competition is very keen. In closing an able address he said that a united effort should be made to try to retain all the old members of the Association, and secure as many new ones as possible for 1896.

The past year of our Society has been a successful one, both in the increase of membership and in the interest taken in our public meetings. We have held four regular meetings as well as the annual. At each of these, addresses or papers, on some subject relating to fruit were given by experienced fruit growers. The acreage of fruits, especially the smaller ones, has been very much increased, a good deal of attention being paid to currants, blackberries and raspberries. In common with many other sections of Ontario, the May frost did a good deal of damage, still, there was sufficient fruit left at remunerative prices, to give growers a fairly prosperous year. Apples were the best crops known for years, and the quality was prime, even the Snow Apple and Holland Pippin being spotless.

As usual, many members took advantage of the annual drive, and spent a pleasant and profitable day among the orchards of the Dundas and Waterdown districts. We also exhibited a collection of fruit at the Industrial Fair, Toronto, to which was awarded first prize.

The following gentleman contributed papers or addresses during the year :—Messrs. W. King on "Small Fruits;" A. W. Peart, "Fertilization of Fruit Blossoms;" J. W. Bridgeman, "Bees in Relation to Fruit Growing," and Geo. N. Peer on "Raspberry Culture."

BRAMPTON.

Officers for 1896.

President.—Dr. D. Heggie.

1st Vice-President.—Henry Dole.

2nd Vice-President.—Dr. C. T. Morse.

Secretary.—A. Morton.

Directors.—C. M. French, H. Roberts, Miss J. Irvin, Mrs. A. W. Woods, Mrs. Mary Graham, A. G. Buckham, E. Fallis, A. McKechnie, A. Morton.

CHATHAM.

Officers for 1896.

President.—His Honor Judge Bell.

Vice-President.—J. A. Walker, Esq.

2nd Vice-President.—Mrs. D. S. Paterson.

Directors.—G. K. Atkinson, W. E. Rispin, T. M. French, Mrs. Elliott and Miss Edith Coltart.

Auditors.—W. F. Malcolmson and W. E. McKeough.

At the meeting of the Directors subsequently held, W. E. Rispin was appointed *Secretary-Treasurer* of the Society.

GRIMSBY.

Officers for 1896 :

President.—John H. Grout.

Vice-President.—Mrs. Adolphus Pettit.

2nd Vice-President.—L. Woolverton.

Secy.-Treasurer.—C. W. Van Duzer.

Directors.—Mesdames E. J. Palmer, D. V. Lucas, E. J. Woolverton, and J. G. Nelles, and Messrs. C. W. Van Duzer, Read, Adolphus Pettit, A. Terryberry.

THE GLADIOLUS.

By Mrs. E. J. Palmer, Grimsby.

I had but little idea of the value of Gladiolus when I began to prepare this paper, and I think we have been most fortunate in choosing it for our initial effort. It belongs to the order Iridaceæ. The roots are bulbous; the leaves linear or sword-shaped, from which it derives its name Gladiolus (Latin for a little sword). The Cape of Good Hope produces the greater number of known species. A few, however, are natives of other

countries, and two or three are found in Central Europe; none are British. The original species have since been superseded by the very numerous and beautiful hybrids that are in cultivation, though many of the originals are retained, and are useful in the mixed border. The Hottentots eat the bulbs of some species which contain a considerable quantity of starch.

The bulbs should be planted in a rich, light, mellow soil, about 20th of May, if the ground is warm, and, for a succession of bloom, every two weeks till the 1st of July. A sunny situation, with ground well spaded and thoroughly pulverized, is the most suitable. If the soil is heavy, plant from one to two inches deep; if light, three to six inches. If bulbs are planted deep they attain a greater size, and are better able to stand a season of drought. They are moisture-loving plants, and, for that reason, they succeed well in England. I think the finest flowers and largest spikes are obtained by late planting, as they come into bloom about the 1st of October. If planted early, they should have a light mulching of newly-cut grass. It is one of the richest of our summer-flowering bulbs, and so refined and delicate in quality of color that it is never anything other than satisfactory. If you care for a soft, pale shade, you have it; if you prefer the brilliant scarlet, crimson or violet, they are before you in every shade. No garden should be without them, or their gorgeous display of bloom. As cut flowers, they are most satisfactory; and if cut when the first four flowers are in bloom, and placed in water, they will open bud after bud till the whole spike is in bloom. The bulbs should be taken from the ground before danger of frost, put in paper bags and kept in a dry cool place free from frost.

I am sure we will derive a great deal of pleasure from the cultivation of our Gladioli. Horace Smith says: "The purest happiness our hearts can enjoy is that which is wafted to us from the hearts we have made happy, even as the flowers which we ourselves have planted ever seem to breathe around us a sweeter and more acceptable fragrance."

HAGERSVILLE.

Officers for 1896.

President.—Wm. Harrison.

First Vice-President.—Albert Snell.

Second Vice-President.—Thos. Harris.

Secretary-Treasurer.—S. W. Howard.

Directors.—J. H. Hager, George Hall, S. B. Harrison, J. W. Husband, P. R. Howard, Capt. Stewart, Henry Byers, George E. Smith, Thos. Beswetherick.

Auditors.—S. B. Harrison and J. W. Husband.

LEAMINGTON.

Officers for 1896:

President.—W. W. Hilborn.

First Vice-President.—Wm. Smith.

Second Vice-President.—John Mitchell.

Directors.—M. T. Bruner, C. Curtis, F. W. Deadman, D. Sinasac, E. Hawkes, E. E. Adams, Geo. Mills, J. C. Ross, J. L. Hilborn.

Secretary-Treasurer.—J. E. Johnson.

LINDSAY.

Officers for 1896.

President.—J. H. Knight.

Vice-President.—Alex. Cathro.

2nd Vice-President.—T. Bryant.

Secretary-Treasurer.—F. J. Frampton.

Directors.—Richard Helson, Col. James Deacon, Robert Speir, Jos. Brickaby, Robt. Chambers, W. H. Stevens, W. King, F. J. Frampton, W. Pedlar.

NAPANEE.

Officers for 1896 :

President.—Mrs. W. H. Wilkison.

Vice-President.—Mr. T. M. Henry.

Secy.-Treasurer.—J. E. Herring.

Directors.—Mrs. Robert Mill, Mrs. R. G. Wright, Mrs. F. S. Richardson, Mrs. Archibald McNeill, James Harmer, James Bowerman, W. S. Herrington, George Lloyd, G. C. T. Ward.

NIAGARA FALLS.

Officers for 1896 :

President.—W. P. Lyon.

Vice-President.—Roderick Cameron.

Second Vice-President.—Thos. Berryman.

Secretary.—E. Morden.

Treasurer.—J. G. Cadham.

Directors.—Mrs. Land, Mrs. Lowell, Miss L. McNally, Rev. Canon Bull, H. G. A. Cook, Geo. A. Pyper, J. G. Cadham, E. Morden, Geo. Lane.

Auditors.—Geo. C. Biggar, Walter Ker.

Number of members, 1895, 100 ; members for 1896 already enrolled, 60. Will give to each member two lilies and three cannas, with perhaps some other bulbs or seeds. Each member will receive two monthly journals. A September exhibition will doubtless be held. Smaller informal shows are also spoken of. There has been an excellent staff of officers from the start. Twenty-three directors' meetings last year, and all of them harmonious. This is not often the case where prizes are given, and might not continue if we adopt that system. We find that our lady directors are very useful.

PARIS.

At the annual meeting of the Paris Horticultural Society the Treasurer's report was read, which showed the Society to be in a flourishing condition. He reported a balance on hand of $119.55. This amount it is proposed to expend on the purchase of bulbs, plants, etc., for the members as they may deem best. It is requested that suggestions as

to what may be the best shall be left with the Secretary-Treasurer by members when renewing their subscription for the next year. We understand that the Society purposes holding a number of meetings during the year; also, that a flower show will be held in the fall, which will be fully appreciated by all lovers of floral and horticulture. The following officers were elected for the ensuing year:

President.—F. Wiley.

Vice-President.—D. M. Lee.

Secy.-Treasurer.—C. H. Roberts.

Directors.—J. Carnie, Sen., L. Gerndt, J. Skea, A. W. Rousell, Mrs. H. Bickle and Mrs. A. Mennie.

PORT COLBORNE.

Officers for 1896.

President.—E. O. Boyle.

1st Vice-President.—L. G. Carter.

2nd " W. W. Knisley.

Secretary.—D. W. McKay.

Treasurer.—A. E. Augustine.

Directors.—W. Hopkins, Mrs. A. K. Schoolfield, Mrs. D. W. Carter, Mrs. J. Steele, J. H. Smith, F. Hoskke, Rev. J. M. Smith, D. W. McKay, A. E. Augustine.

PORT HOPE.

Officers for 1896.

President.—H. H. Burnham.

Vice-President.—Wm. Craig.

Secretary-Treasurer.—A. W. Pringle.

Directors.—W. W. Renwick, John Smart, P. Brown, S. Wicket, S. G. Watson, T. J. Tilley.

The first annual meeting of the Port Hope Horticultural Society was held in the Opera House, Port Hope, March 9th, 1896.

Owing to the absence of the President, Mr. H. H. Burnham, the chair was taken by Mr. William Craig.

Doctor Purslow, the first speaker of the evening, then read an interesting paper on "The Pillaging of our Gardens." The doctor said that if the Horticultural Society was to thrive, it must put this down. There were two kinds of depredations; the robbing of flowers, which was done mostly by young girls, and the robbing of fruit, by boys and young men. The remedies proposed were: Bringing it before the pupils in the schools; inserting articles against it in the local papers, and distributing leaflets against it. In case this did not succeed, the doctor thought the horticulturists should resort to the law. As this is seldom done individually, he suggested the horticulturists forming a committee called the "Garden Protective Association," to prosecute all offenders, and thus protect the members of the Society. If any difficulty was found in discovering the culprits, to engage the services of a professional detective, the expense to be borne by the Society. The doctor thought that if this were done, and a few examples made, the members would have no trouble in this direction.

INSECT LIFE.

Dr. BETHUNE then gave an address, of which the following is an abstract :

Mr. CHAIRMAN LADIES AND GENTLEMEN,—I have been very much pleased that a horticultural society has again been formed in this town. When it was proposed to me to take part in this, the first annual meeting of the Port Hope Horticultural Society, I was at a loss to know what to bring before you, unless it were my favorite subject, that of insects.

Every person knows that there is a great variety of insects. Probably you are not aware that the insects more than equal all the animals that inhabit the earth both in number and bulk. We must not, of course, include the fishes of the ocean, as we do not know their numbers, but confine ourselves to the inhabitants of the earth. The insects, then, more than equal all the other animals of creation. Just one instance of their numbers : A writer says that he observed a flight of locusts crossing the Red Sea and covering two thousand square miles. He calculated that the locusts would weigh about one-sixteenth of an ounce each, and computed that they would weigh altogether forty-thousand millions of tons. It seems incredible.

What I thought of doing to-night was not so much to entertain as to instruct. This is only the first meeting of the Port Hope Horticultural Society, and I may perhaps be called upon to give you further information at some future time so will confine myself to-night to some remarks upon insects.

The first question that rises in the mind is, what is an insect? I suppose everyone thinks they know what constitutes an insect. Some will tell you that a spider is an insect, but it is not. They are first cousins of insects, but they do not belong to that class themselves, though they are very near relatives. Take thousand legged worms ; they are closely allied to insects, but they are not insects themselves.

Well, an answer to the question as to what constitutes an insect, is, of course, its structure. We find that these creatures are all built on a certain plan ; there is a plan upon which the great Creator has chosen to work. In their formation we find the body divided into three distinct parts. The first division is the head, the second is the thorax, and the third the abdomen. The head contains the mouth ; the thorax, the legs and wings, and the abdomen the breathing apparatus and other internal organs.

What may surprise some is that the breathing apparatus is contained in the abdomen, the third part of the body. Some people try to kill an insect by closing its mouth, but it does not affect it at all. They dip its head into oil, but, beyond inconveniencing it a little, it does it no harm. The reason is plain to be seen—they do not subject the right part of the insect to the oil.

You will notice on these diagrams (pointing to some on the wall) that there appear feelers on most of them, especially on the butterfly. These are called antennæ, and they are organs of sensation of the insect. You will notice that in an insect there will always be found a pair of antennæ.

In their perfect state insects always have at least one pair, but mostly two pairs of wings. Those that have only one pair, have rudiments of a second pair. The flies are the only ones that are destitute of two pairs.

Then the next distinction is that they all have six legs in the perfect state—I am speaking of the winged state. In this stage all insects have six legs—never more or less—except in the case of some butterflies, which have only four. If you find one with six legs, then you know that it is an insect.

I just said that I was referring to the perfect state, but there are others as well. You will see by these diagrams that there are different stages. All insects go through four stages to a greater or less extent.

The egg is the first state. Insects begin life, like all living creatures, as an egg. The egg is laid and from the egg is produced a little caterpillar, grub or maggot. The caterpillar grows very rapidly and goes on eating during its existence. It afterwards

assumes a dormant state ; some burrow in the ground while others wrap themselves up in a silken cocoon.

Grasshoppers, etc., do not go through such complete stages. The larva of a grasshopper is very much like the perfect insect when born, except that it has no wings. This, then, is an exception but, as a general rule, there are four stages of existence

In the caterpillar, this rule about the six legs does not hold. There are, however, a series of legs, called pro-legs, which help the insects to move along. The majority of the insects are all supplied with these appendages which answer the purpose of legs There are some others, though, which do not. Taking it as a whole, then, this is the usual form in which these creatures are constructed ; but this is a very large subject and I will not have time to dwell on this any longer.

The next point is :

The Mode in Which Insects Feed.

There are two kinds of insects—those that feed by biting with their jaws and those that feed by suction. You can see that if you want to kill a biting insect you would have to adopt a different plan than you would to kill a sucking insect. Horticulturists have to understand these two systems and to base their actions accordingly.

I was intending to tell you something about the different families, but I think I will change my line and say a few words about dealing with noxious insects. Everyone knows what plagues they are. Personally I am indebted to them.

A number of years ago a number of us formed an entomological society, and had great difficulty in getting along, having to depend entirely upon ourselves. We started a magazine. By correspondence we found that there was a scourge affecting the potato in the Western States. I had occasion to visit Chicago and found it to be true. We immediately set to work to learn all we could about it. I wrote an article in the Toronto *Globe* and one in the *Canada Farmer*, calling upon the Government to make some effort to keep this troublesome pest out of Canada. Our idea was by not growing any potatoes for some distance from the border, we might check their progress. The long and short of it was that we started to work and formed a committee for experimenting. It was found that Paris green was the one effective remedy. After this the Government of Ontario gave us an annual grant, which they have continued for some years past, and gradually increased to a thousand dollars a year.

Speaking of Paris green reminds me that it has now become the greatest means of destroying insects that has ever been discovered. It is generally delivered by means of pumps which send a fine spray through the foliage.

Another insect that gives a great deal of trouble is the codling worm, which burrows into the heart of the apple. This codling worm has been a very difficult worm to get rid of. The moth lays its egg in the eye of the future apple. It generally destroys the apple and it falls to the ground.

With regard to the use of Paris green by spraying the trees just when the apple is formed. The Paris green is spread all over the tree by means of the spray-pump When the caterpillar starts out of the egg to burrow into the apple, the first thing it does is to eat some of the Paris green and is consequently destroyed. The plum weevil will also be kept in check by spraying with Paris green. So far we have been dealing with biting insects.

We will now turn to those that live by sucking. It would be no use spraying anything on the foliage. You have to apply it to their bodies The remedy is coal oil, but if applied to the foliage direct, the plants would be killed. By experiments it was found that if this coal oil was mixed with water it would destroy the insects and yet not damage the foliage. However, water is not the best thing to mix it with. If you take some soap and water and make strong soap suds, it will make a better mixture than water alone ; it will form an emulsion and you can then keep it for any length of time. Use a

spray pump in the usual manner and these insects can be destroyed in the same way. Those insects that trouble house plants can be destroyed also with the emulsion.

Now in regard to

SPRAYING TREES.

I know by personal experience that it is too much trouble. We either have not the time to spare, or we are too lazy, and let our trees be ravaged by insects year after year. I want to make a suggestion in regard to this. It is that our gardeners should do this work for us. Those that cultivate flowers and fruit, would be only too glad, I am sure, to pay a man if he would come around and spray our trees for us. I hope the gardeners of our town will take this matter up and act upon it. It would be a great blessing to those of us who are either too busy, or too lazy, to do it ourselves. However, if you do not come under this classification and do it yourself, be sure and put on an old suit of clothes.

I will now just refer to one or two other matters. There has been a very remarkable case of interest to ourselves in California. You all have heard of what a wonderful country California is for fruits. California fruit growers have been suffering from a scale insect that invaded the State a few years ago. In their trouble they sent for assistance to the department at Washington, and Professor Riley proceeded to investigate. (I have no hesitation in saying that Professor Riley has done more in making the habits of insects known than any other person in North America or even the world.) He knew it must have come from some other part of the world. He at once took up the study of this scale insect. He found that the Californians had been importing fruit trees from New Zealand and Australia, and came to the conclusion that the insect must have been imported with the trees. However, in Australia and New Zealand the scale was scarce, and the inference was that there must be something that kept it in check. He asked the authorities at Washington to send over a couple of men to Australia and New Zealand to investigate and find what was keeping it in check. The Department would not grant his request. However, he succeeded in another way. There was to be an international exhibition at Melbourne and the American Government were sending over representatives. He succeeded in getting two of his own men appointed, and when they got there I can assure you they did not spend much time at the exhibition but in searching for this insect. They found that a little beetle called a "lady bird" was keeping them in check. They sent some of these lady birds over to Mr. Riley by mail and he had them placed on some trees where the scale insects were at work, with the result that they soon cleared the trees of them. More were then sent from Australia. Now they are not troubled with the scale insect at all. This, I consider was a great triumph for entomology. But some things that are imported do harm instead of good, like the English sparrow for instance.

The same thing is now being done in Western Virginia. The forests were being invaded by some noxious insects. So they imported some insects they thought would destroy them from Germany. In a large forest you cannot watch the results as closely as in an orchard, but I believe the experiment there also will be successful. I only mention this as an example of what has been done by entomology.

Before I sit down, I want to speak about another matter. It is that every person should have a hobby of some kind. I have derived a great deal of pleasure from the study of entomology. I would like particularly to impress upon you the importance of having a hobby. You, who are confined all day, take up something that is entirely different from your regular occupation for your spare moments. What I would like you to do, and especially the young ladies of the town, is to study some branch of natural history.

Some time ago I had a talk with Lady Aberdeen on this subject. She is very much interested in the welfare of this country and its people. We were talking about this matter, and I was deploring the lack of this sort of study by our young ladies. In England it is quite common but not in this country. There are plenty of ladies in Port

Hope who would find their life much more pleasant to them if they would take up something of this kind. I believe the Ladies' Club have lately had a scientific lecture, and I am glad of that.

One study they might take up is botany, or some like shells and fossils; others, again, collecting postage stamps. But take something, no matter what it is, and make that something the whole object of study for your spare moments. Many people go for a walk for exercise. If you are a student of botany you will find something interesting at every step; if you are making a collection, you will find something to add to your collection. I should be glad to see the ladies of this town take up botany and other natural history studies.

I might mention that the greatest entomologist in Great Britain is a lady, Miss Ormerod. These diagrams that you see here are the work of her sister and herself. She is the standard authority in England, and has been consulted by the Governments of Russia, India and others. A few days ago I received her eleventh annual report. She devotes her whole time to the pursuit, and without any encouragement whatever from the Government. Happily, she is a lady of means, and is able to do it. If you read the periodicals you will find mention made of her from time to time. I mention this as a bright example, but there are other ladies who have distinguished themselves in different directions. So you see what a lady can do.

In closing, let me say that every one cannot be famous, but you can derive great pleasure by studying some of the wonderful works of the Divine Creator.

Mr. T. H. Race, of Mitchell, representing the Ontario Fruit Growers' Association, was then introduced by the chairman, and proceeded to give an address on "The Cultivation of Roses."

TRENTON.

Officers for 1896.

President.—W. H. Berkinshaw.

Vice-President.—R. Fraser.

2nd Vice-President.—W. H. Dempsey.

Secretary-Treasurer.—S. J. Young.

Directors.—Mesdames J. W. Hyde, W. H. Berkinshaw, J. H. Stewart, Miss Jeffs, and Messrs. J. B. Young, Jas. Craig, R. M. Foster, J. B. Christie and D. J. Hawley.

Auditors.—Messrs. D. E. Clarke and J. Nicholson

WATERLOO.

Officers for 1896.

President.—James Lockie.

1st Vice-President.—Chas. Moogk.

2nd Vice-President.—Mrs. P. Hohmeier.

Secretary-Treasurer.—W. A. Raymo.

Directors.—Mrs. Geo. Wegenast, Mrs. J. H. Webb, Miss M. Bruce, Messrs. Geo. Bulduc, C. M. Taylor, J. H. Winkler, Wm. Hendry, J. H. Roos.

Auditors.—George Davidson, Levi Shuh.

Following is the

Directors' Report.

Your Directors, in making their first Annual Report, have much pleasure in congratulating the members on the success of the Society. From its inception it has been well received and seems to be steadily growing in public favor.

We have had a membership of seventy, each of whom received *The Canadian Horticulturist* and bound report of the Ontario Fruit Growers' Association, and a share of the plant distribution connected, twenty Gladioli bulbs, one Canna and two tuberous rooted Begonias; besides, the Society made a gift to the town of a circular flower bed in the public park, containing 175 Dwarf Cannas with a border two feet wide of Phlox Drummondi, which was much appreciated by the public, and we trust the Park Commissioners will continue the work thus begun and cause several flower plots and ornamental trees and shrubs to be planted in the different parks in future.

The year 1895 was unfavorable for horticulture in many respects. The frosts of May almost completely destroyed the small fruit crop of this section and cut back early vegetables and flowers. The weather during the season was very irregular and uncertain, alternating from the extreme heat to cool, even cold, weather, with frost every month.

Your Society has held a number of meetings open to the public, where papers on horticultural subjects have been read and discussed with increasing interest, and we trust our successors will continue such meetings in future and that the attendance may increase, as apart from the benefits to be derived from an interchange of ideas on horticultural topics, they also cultivate the social qualities and make better neighbors and citizens.

The Fruit Growers' Association of Ontario, with which this Society is affiliated, hold their annual meetings in different places each year in order to increase the interest in fruit growing in different localities. Your Directors made an effort to get it here next winter, but having been held in the western section for some years it was decided to hold the next in Kingston, but we are promised it in the near future, and we trust our successors in office will succeed in getting this meeting at Waterloo in 1897.

The Secretary-Treasurer's and Auditors' reports are before you by which you will see the Society is in a good financial position, the funds having been husbanded with care, and by the circular just issued you will see the advantages to members for this year are much greater than last, so that we look with confidence to the increasing influence of this Society and expect it to be one of the most beneficial and permanent institutions of our thriving town.

By order of the Board.

Jas. Lockie,
President.

WOODSTOCK.

Officers for 1896.

President.—D. W. Karn.

Vice-President.—G. R. Pattullo.

Secretary.—R. B. Thornton.

Treasurer.—J. S. Scarff.

Directors.—E. Hersee, M. S. Schell, F. Mitchell, Frank Harris, E. W. Snelgrove, Wm. Newton, R. W. Keiler, J. S. Scarff and T. H. Parker.

Auditors.—John Pike and T. L. Clarkson.

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SECOND ANNUAL REPORT

OF THE

FRUIT EXPERIMENT STATIONS

OF

ONTARIO

UNDER THE JOINT CONTROL OF THE

ONTARIO AGRICULTURAL COLLEGE, GUELPH,

AND THE

FRUIT GROWERS' ASSOCIATION OF ONTARIO.

1895.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.

TORONTO:
WARWICK BROS. & RUTTER, PRINTERS ETC., 68 AND 70 FRONT ST. WEST.
1896

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SECOND ANNUAL REPORT

OF THE

FRUIT EXPERIMENT STATIONS OF ONTARIO,

1895.

To the Honorable the Minister of Agriculture for Ontario :

SIR.—The second Annual Report of the Fruit Experimental Work in Ontario, which I have now the honor of placing before you, will show the progress of our fruit stations in testing varieties. The experimenters are beginning their tests with old varieties, and afterward will be in a position to judge of the comparative merits of the newer varieties.

The Board of Control has now established ten stations and two sub-stations, and it is hoped that these will fairly represent the conditions of the various parts of the Province, excepting those too far north to be adapted to profitable fruit culture.

An important feature of the work is that undertaken by the secretary, viz., a descriptive work of the fruits of Ontario, a work necessarily slow and requiring much patient study of varieties under the varying conditions found at the various stations, but in the end it is intended to constitute in a compact form the results of the work of all our stations. When sufficiently advanced, this may be published in a volume separate from the Annual Report and thus will constitute a book of reference for fruit growers.

The Report of the Director of Experimental Spraying also forms an important part of this report.

All of which is respectfully submitted.

We have the honor to be, Sir,

Your obedient servants,

JAMES MILLS,
Chairman, Guelph, Ont.

L. WOOLVERTON,
Secretary, Grimsby, Ont.

BOARD OF CONTROL, 1896.

REPRESENTING THE COLLEGE.

JAMES MILLS, M.A., LL.D., Guelph ..... President.
H. L. HUTT, B.S.A., Guelph ..... Horticulturist.

REPRESENTING THE FRUIT GROWERS' ASSOCIATION FOR 1896.

A. M. SMITH ..... St. Catharines.
A. H. PETTIT ..... Grimsby.
W. E. WELLINGTON ..... Toronto.
L. WOOLVERTON, M.A., Secretary ..... Grimsby.

EXECUTIVE COMMITTEE.

Chairman—JAMES MILLS, M.A., LL.D.
Secretary—L. WOOLVERTON, M.A.
Official Visitor—H. L. HUTT, B.S.A.

THE ONTARIO FRUIT EXPERIMENT STATIONS.

	Name.	*Specialty.*	*Experimenter.*
1.	Southwestern	Peaches	W. W. Hilborn, Leamington, Ont.
2.	Niagara	Tender Fruits	Martin Burrill, St. Catharines, Ont.
3.	Wentworth	Grapes	M. Pettit, Winona, Ont.
4.	Burlington	Blackberries and Currants	A. W. Peart, Freeman, Ont.
4½.	Halton sub-station	Strawberries	E. B. Stevenson, Freeman, Ont.
5.	Lake Huron	Raspberries and Commercial Apples.	A. E. Sherrington, Walkerton, Ont
6.	Georgian Bay	Plums	John G. Mitchell, Clarksburg, Ont.
7.	Simcoe	Hardy apples and hardy cherries.	G. C. Caston, Craighurst, Ont.
7½.	Simcoe sub-station	Gooseberries	S. Spillett, Nantye, Ont.
8.	East Central	Pears and Commercial Apples.	R. L. Huggard, Whitby, Ont.
9.	Bay of Quinte	Apples	W. H. Dempsey, Trenton, Ont.
10.	St. Lawrence	Hardy Pears, Hardy Plums.	Harold Jones, Maitland, Ont.

FRUIT EXPERIMENT STATIONS OF ONTARIO.

CANADIAN FRUITS AND FRUIT TREES.

Since we have in Canada no recognized authority upon Canadian fruits, it seems necessary for the best interests of Canadian fruit growers that such a work be undertaken as soon as possible. That grand work of Mr. A. J. Downing has been of inestimable value to the horticulturists of the United States, but even for that country this work needs a thorough revision; while for Canada, many of its statements are wholly inapplicable. Besides this, it describes many varieties never grown in Canada and wholly undesirable.

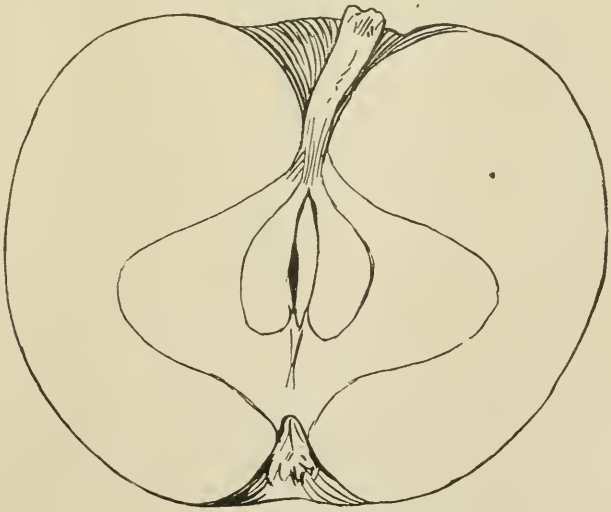
Toward supplying this need, your Secretary did a little work during the year 1895, and has incorporated a portion of it in this annual report in order to learn the mind of the Board of Control and of the Fruit Growers' Association with regard to the desirability of its being carried on in this manner from year to year as the practical outcome of the work of our Ontario fruit experiment stations.

L. WOOLVERTON,
Secretary.

GRIMSBY, Ontario.

APPLES.

BALDWIN. (Steele's Red Winter).



Section of Baldwin.

The Baldwin originated in the State of Massachusetts and was for many years the most popular winter apple for either home or foreign markets. The average yield each alternate year was about eight barrels per tree, and in some instances much larger. Large

orchards of this variety were in consequence planted in the apple growing counties of middle and southern Ontario, but unfortunately for many years now these orchards have been almost barren, and many of them are being dug out as worthless. The cause may be poverty of soil, the lack of pollen of other varieties to fertilize the blossoms, or the prevalence of apple scab. If it is the latter, it may be overcome with the Bordeaux mixture; if lack of potent pollen, by grafting in other varieties here and there through the orchard.

TREE, upright, spreading, vigorous grower, formerly very productive.

FRUIT, large, roundish, ovate; skin yellow, shaded and splashed with crimson and red, dotted with some russet dots; stem heavy, three-quarters of an inch long, in a broad cavity; calyx, closed, in a deep plaited basin.

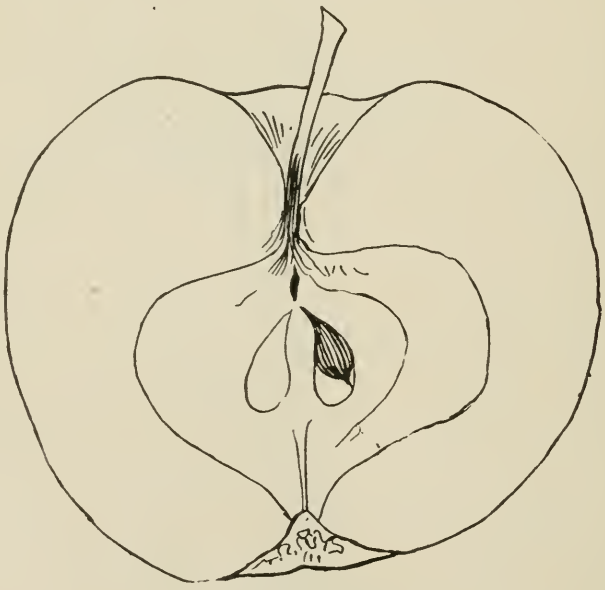
FLESH, yellowish white, tender, sub-acid; quality, second class.

SEASON of use, January to March.

ADAPTATION. Not very hardy at Simcoe station or in North Ontario county; further south and along the borders of the lakes, this apple may be grown to perfection, if the scab can be kept off the trees.

CABASHEA. (Twenty Ounce Pippin).

Not worth planting in Ontario. Through confusing its name with that of the Cayuga Red Streak, often called Twenty Ounce, this apple has been widely planted in our province. The tree is unproductive and the fruit, though large and fine in appearance, drops early and is poor in quality. Twenty trees, at Maplehurst, twenty years planted, yielded about ten barrels of apples in 1895, the best so far.



Section of Cabashea.

ORIGIN, unknown.

TREE, vigorous, spreading, unproductive.

FRUIT, large, roundish, oblate, slightly conical; skin, yellowish green, shaded with dull red on the sunny side; stem, an inch long, stout, in a wide cavity of moderate depth; calyx open in a wide shallow basin; core medium.

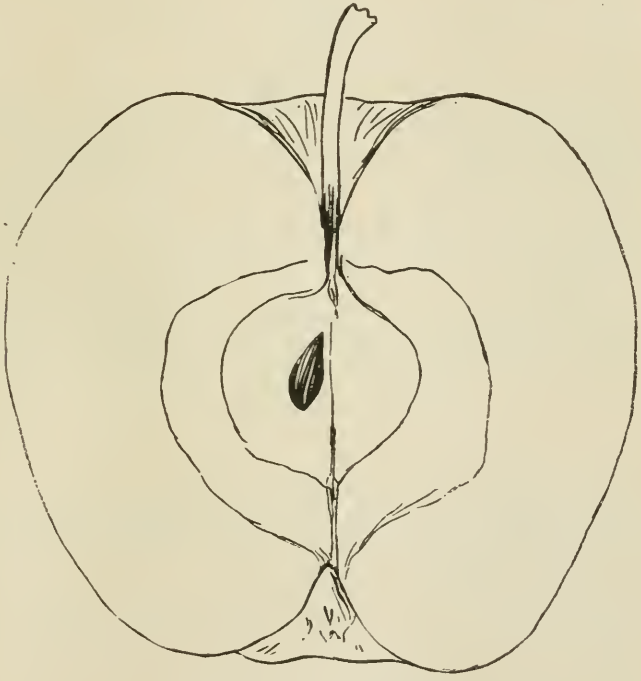
Flesh, white, firm, coarse, sub-acid, only fair for cooking, useless for dessert.

Season, October to December. At Bay of Quinte station, season given from December to February.

Tested, twenty years at Maplehurst, Grimsby.

Cranberry Pippin.

An apple that is worthy of being planted in Southern Ontario as a fancy variety for export. Though the quality is ordinary and not suitable for dessert, its extreme beauty when opened in midwinter, its large and even size, usual freedom from blemishes and the productiveness of the tree every alternate year, make it a desirable variety. At Maplehurst, Grimsby, in 1895, fifty trees of this variety, about twenty years planted, yielded 200 barrels of high grade apples, and in 1893, when other varieties were almost worthless, nearly the same quantity. Sometimes, however, this variety is subject to warts and knots which mar its beauty.



Section of Cranberry Pippin.

Origin. Accidental on a farm, near Hudson River, N.Y.

Tree, very vigorous, healthy, spreading, productive.

Fruit, medium to large, roundish oblate; skin, smooth, yellow shaded and stripe with two shades of red; stem, slender, one and one-eighth inches long in a deep cavity; calyx closed in a wide, wrinkled basin.

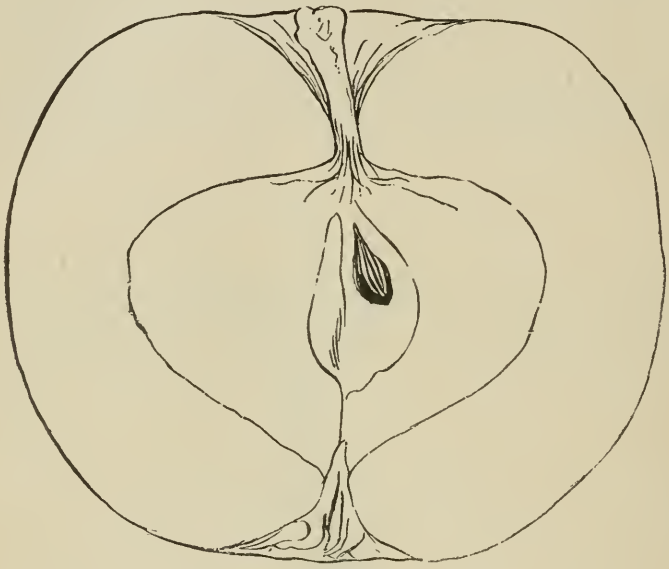
Flesh, white, firm, crisp, moderately juicy, sub-acid; quality, second class.

Season. November to February.

Adaptation. Southern portions of the province, especially clay border of the lakes.

King. (King of Tompkins' County.)

Said to have originated in New Jersey. On account of its excellent quality for cooking, its peculiarly rich aromatic flavor, its beautiful appearance and large size, this apple is taking the highest place in the great apple markets of the world. Unfortunately the tree is a poor bearer, and consequently unprofitable as an orchard variety, unless under exceptional circumstances. Top-grafted on Tolman Sweet, it is said to be more productive. For home use it is excelled by no apple.



Section of King.

Tree, a vigorous grower, of spreading habit, but not long-lived.

Fruit, large, roundish, uneven; skin, yellowish, shading off from red to dark crimson; stem, short and stout, inserted in a wide, deep, somewhat irregular cavity; calyx closed in a broad, shallow, slightly corrugated basin.

Flesh, yellowish, white, crisp and juicy, moderately firm; flavor rich, agreeable, aromatic; quality first-class.

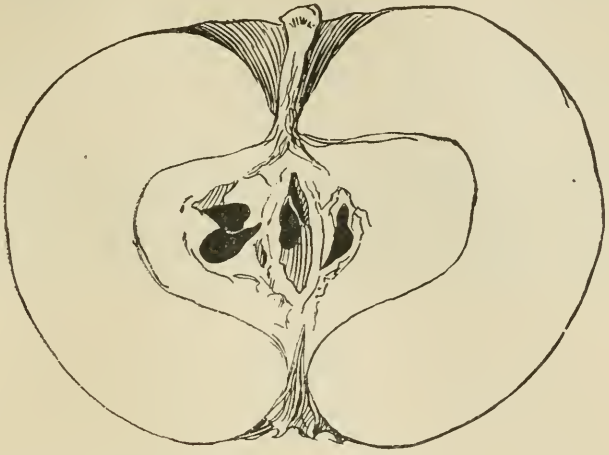
Season, October to February in Southern Ontario; reported at the Simcoe station, October to March for Northern Ontario.

Adaptation. Not hardy at Simcoe station unless top-grafted on Tolman Sweet, or some other hardy stock, and, therefore, it is not recommended for planting in northern sections.

Red Astrachan.

Imported from Sweden to England in 1816, and widely planted in Southern Ontario for a summer market apple. Scarce another apple of its season equals it in beauty of appearance, for, in addition to its rich crimson color, it is often covered with a pale white

bloom. Selected fancy grades of this apple are usually in good demand in our home markets, but sometimes there is a surplus, and prices even for Astrachans are very low.



Section of Red Astrachan.

TREE, upright; very vigorous; begins bearing early; very productive.

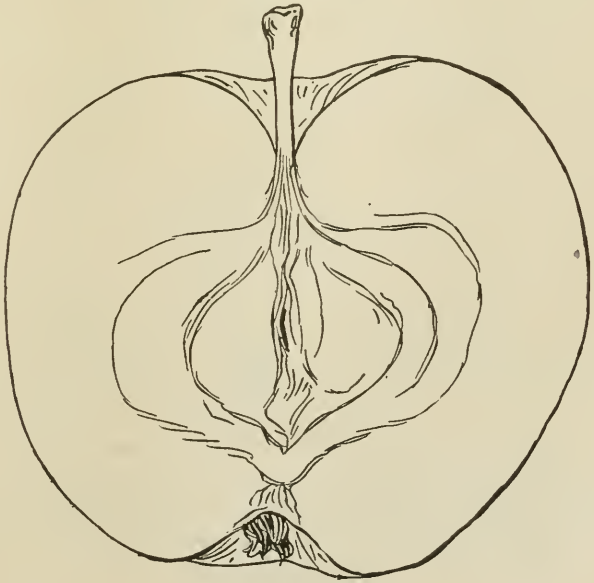
FRUIT, medium to large, round, narrowing toward apex; skin, deep crimson when exposed to sun, yellowish-green in shade, often covered with a thin, whitish bloom; stem, stout, three-quarter inch long, in a deep, narrow cavity; calyx closed in a shallow, somewhat irregular basin.

FLESH, white, crisp, juicy, tender, becoming mealy when over-ripe; acid almost too tart to be counted first-class for either dessert or cooking; quality, second class.

SEASON, 1st to 20th August.

ADAPTATION. In Niagara district perfectly hardy and productive. Two trees in 1895 at Maplehurst averaged ten barrels each. Not considered profitable at Simcoe station; not hardy in northern parts of Ontario county.

YELLOW TRANSPARENT.



Yellow Transparent.

An apple which may prove a substitute for the well-known Early Harvest, which is so subject to apple scab. This variety seems to be proof against fusicladium, both in leaf and fruit.

ORIGIN, St. Petersburg, Russia. Imported by the U.S. Department of Agriculture in 1870.

TREE, hardy, vigorous, upright, annual bearer, productive, began bearing at four years at Craighurst station.

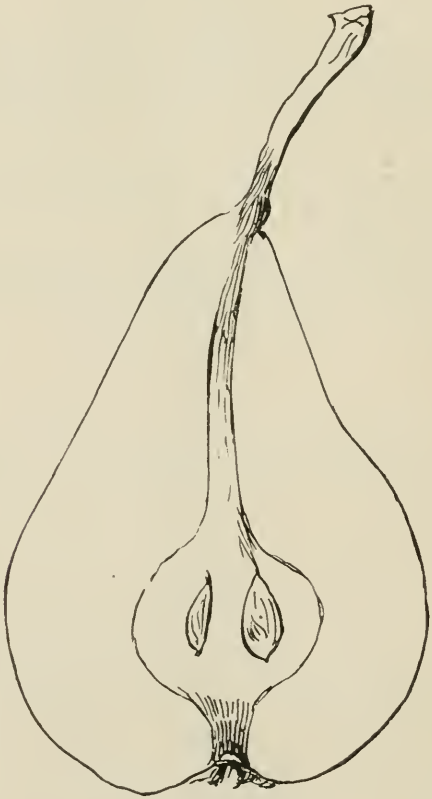
FRUIT, above medium, roundish, oblate, inclined to be conical; skin, clear white, yellowish white when very mature; dots, light green, obscure; stalk, medium, in large cavity; calyx closed in medium slightly corrugated basin; fruit hangs well on the tree.

FLESH, white; firm till very ripe, then tender; quality, second class.

ADAPTATION. Tested at Maplehurst, Grimsby; at Simcoe station, and distributed widely by Ontario Fruit Growers' Association in 1886.

PEARS.

BEURRE GIFFARD.



Section of Beurre Giffard.

An excellent early summer pear, of large size and good quality. Probably no pear of its season is more desirable both for home use and market.

ORIGIN. Chance seedling with M. Giffard, Angers, France.

TREE, moderately vigorous, healthy and productive.

FRUIT, medium, acute pyriform ; skin, greenish-yellow, shaded with red in the sun ; calyx closed in a very shallow basin.

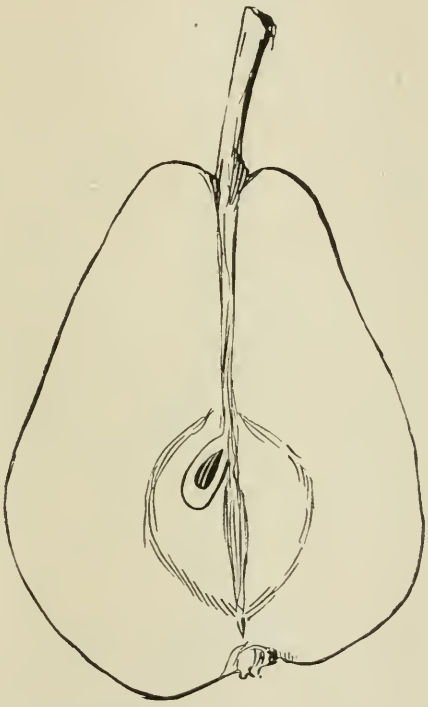
FLESH, white, melting, agreeable aromatic flavor.

SEASON, August.

Tested on top graft four years at Maplehurst, Grimsby ; also at the Wentworth Experiment Station.

BUFFUM.

A reliable kind for health of tree and productiveness, but its season follows the Bartlett too closely to be of any great value in the market. Besides, there are other varieties of about the same season which are more desirable for both table and market, for the fruit is often below medium size and of only fair quality.



Section of Buffum.

ORIGIN Rhode Island.

TREE, very upright, vigorous, productive, not subject to blight.

FRUIT, medium, oblong, obovate, slightly one-sided ; skin, yellowish, with a brownish-red cheek, with small brown dots ; stalk, one inch long, in a very small cavity ; calyx closed in a small regular basin.

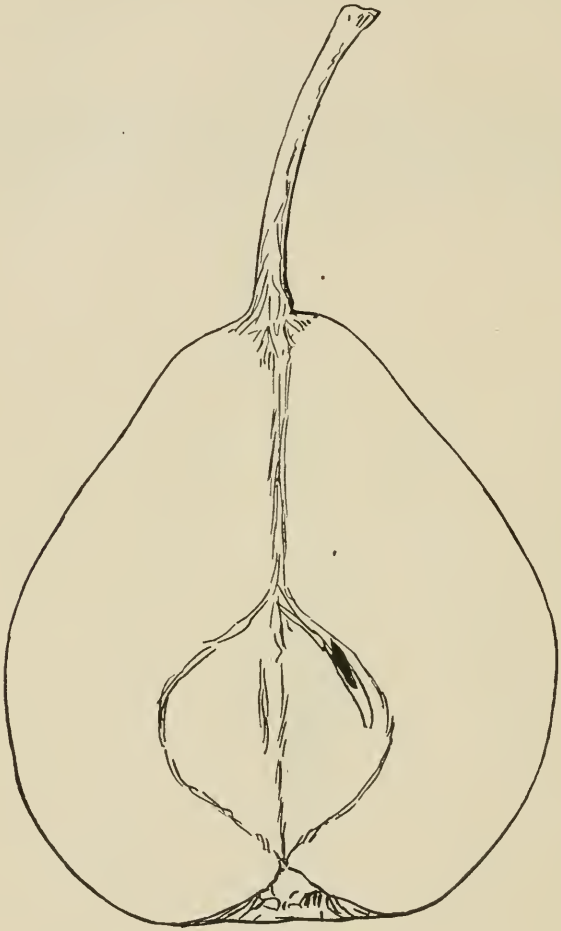
FLESH, white, buttery, moderately juicy, slightly granular, of agreeable aromatic flavor.

SEASON, September 20th to October 1st.

Tested at Maplehurst thirty years.

HOWELL.

One of the best market pears of its season for Southern Ontario, especially when grown on a standard. Its vigor of tree, regularity of bearing, clear skin, and good size and quality make it a desirable variety for the commercial orchard.



Section of Howell.

ORIGIN. New Haven, Conn. Named after the originator, Thomas Howell.

TREE, upright, healthy and vigorous, an early bearer, productive.

FRUIT, large, obovate pyriform ; skin. yellowish green, waxen, reddish dots on sunny side, russet dots in shade ; stem one and three-quarter inches long ; no cavity, sometimes lipped ; calyx partly open in a deep russeted basin ; core small ; seeds few, small.

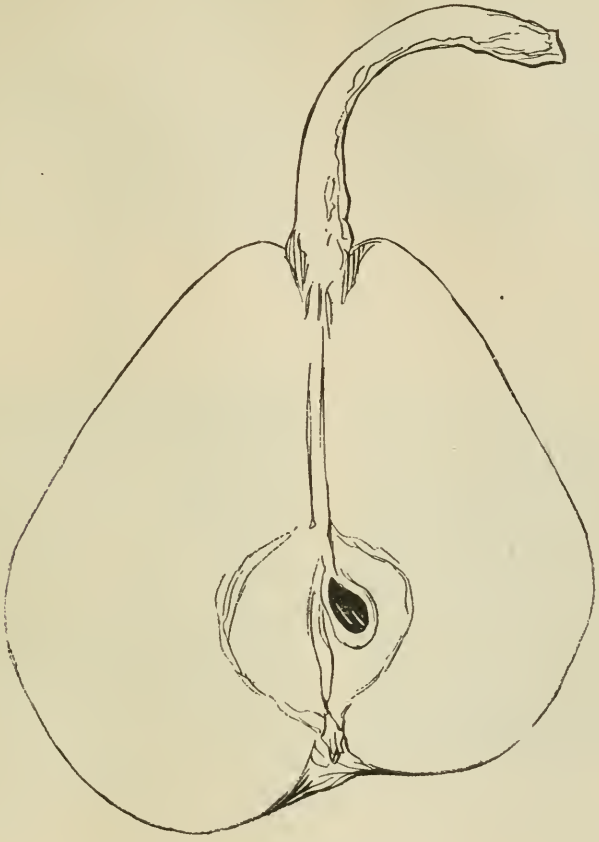
FLESH, creamy white, juicy, melting, granular near the core ; flavor agreeable vinous ; rather tart for dessert.

SEASON, middle September to middle of October.

Tested twenty-five years at Maplehurst, Grimsby.

King Sessing.

A worthless variety for either home use or market, because it always decays at the core, while still apparently sound.



Section of King Sessing.

Origin. Near Philadelphia.

Tree, fairly vigorous, of sprawling habit.

Fruit, large, obovate, obtuse pyriform; skin, greenish-yellow, with minute greenish dots; stem, two inches long, curved, fleshy at its insertion in a small uneven cavity; calyx small, closed in a deep irregular basin; core small, inclined to rot.

Flesh, whitish, juicy, melting, and of good flavor.

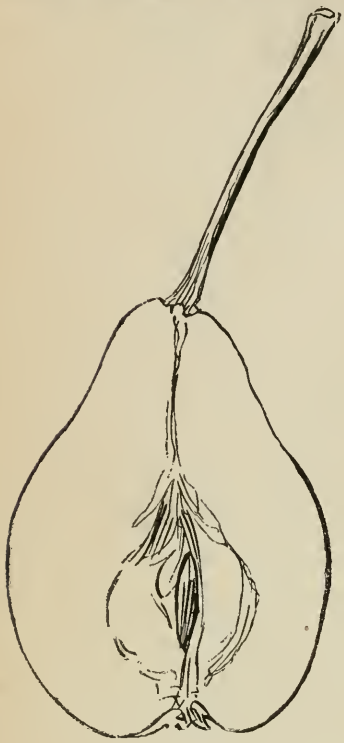
Season, September 20th to October 1st.

Tested thirty years at Maplehurst.

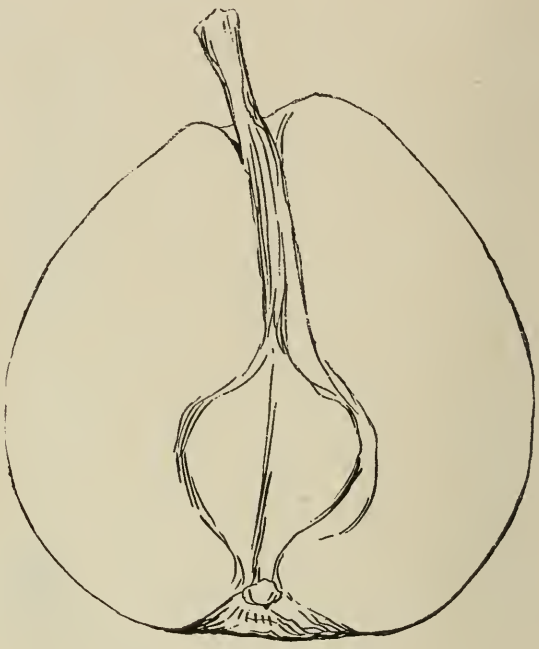
Rostiezer.

A small unattractive looking pear, of very high quality. It is the best of its season in quality for dessert purposes, and should have a place in the home garden. What the

Seckel is in October, this pear is in August. Packed in small packages and labelled "extra quality dessert pears," the writer was able to sell them at a fancy price, but usually the pear sells far below its value on account of its ordinary appearance.



Section of Rostiezer.



Section of Sheldon.

ORIGIN. Foreign.

TREE, healthy, vigorous, sprawling habits, shoots few, and need shortening in.

FRUIT, small to medium, obovate, oblong pyriform; skin, green, sometimes turning yellowish, with reddish-brown cheek; stem slender and nearly two inches in length; calyx open; basin small.

FLESH, juicy, melting, sweet, very delicious, of very finest quality.

SEASON, middle to end of August.

Tested twenty years at Maplehurst.

SHELDON.

One of the most delicious of dessert pears, if eaten just at the proper time. Worthy of a place in every home garden, but not productive enough to be planted for market.

ORIGIN. Accidental on farm of Norman Sheldon of Huron, Wayne Co., N.Y.

TREE, vigorous, erect, not very productive, late coming into bearing.

FRUIT, above medium in size, roundish, obtuse obovate; skin, yellowish-green, covered with thin light russet, brownish crimson in sun, russet dots; stalk, short, stout, in a narrow cavity; calyx nearly open, in a broad basin.

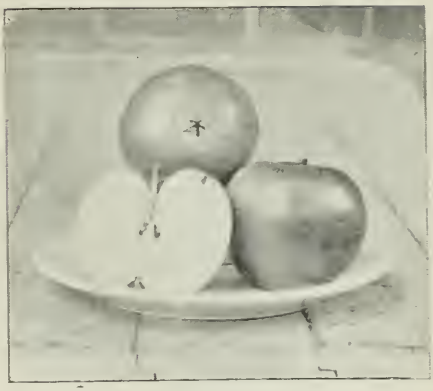
FLESH, creamy, buttery, juicy, sweet, aromatic.

SEASON, October.

Tested twenty years at Maplehurst.

PLATE I.—ONTARIO GROWN APPLES.

BALDWIN.

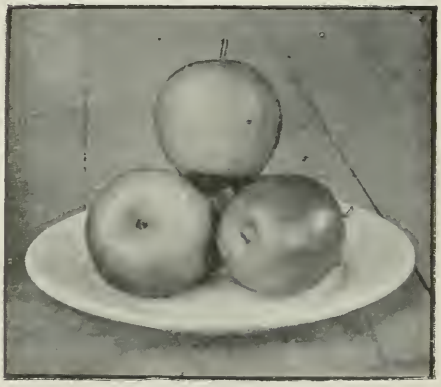


CABASHEA.

CRANBERRY PIPPIN.

KING.

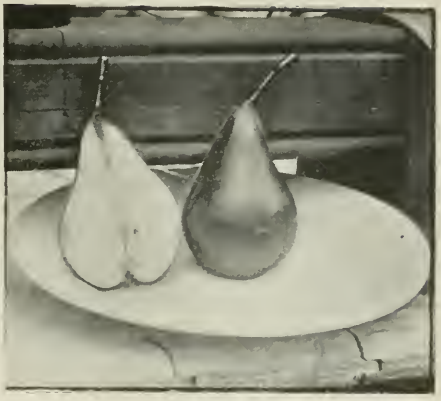
RED ASTRACHAN.



YELLOW TRANSPARENT.

PLATE II.—ONTARIO GROWN PEARS.

BUFFUM.



GIFFARD.

HOWELL

KING SESSING.

ROSTIEZER

SHELDON.

MEETINGS OF BOARD OF CONTROL.

The second annual meeting of the Board of Control was held at the Ontario Agricultural College, Guelph, on the 17th of December, 1894, at 7.30 p.m., at the call of President Mills.

There were present the Chairman, Secretary, Official Visitor, and Messrs. A. H. Pettit, A M. Smith and W. E. Wellington, the members who were appointed by the Ontario Fruit Growers' Association at Orillia on the 5th of December.

The minutes of the last meeting and the proposed report of the Board to the Department of Agriculture were read by the Secretary and duly criticized and amended.

It was ordered that this report, as amended, be submitted to the Minister of Agriculture.

A report of the visits to the various fruit experiment stations was made by Messrs. Hutt and Woolverton.

It was ordered that the Executive Committee be authorized to certify to the Depart ment that the grants to the various experimenters had been properly deserved.

The Executive was asked to call the attention of the experimenters to the importance of planting all new varieties of trees and plants in plots where exact records could easily be made of their behavior, and to which access would be easy for the Official Visitor.

The applications for new stations were read by the Secretary, and the Official Visitor reporting favorably, Mr. John Mitchell, of Clarksburg, in the Beaver Valley, was duly appointed as one of our experimenters, his specialty being plums, but, in addition, he is to be asked to test certain varieties of pears, apples and cherries.

It was further ordered that, in case the conditions were found to be favorable, substations for testing small fruits in particular be located in the counties of Halton and Simcoe.

It was ordered that experiments in spraying be conducted by our experimenters at such time and in such manner as shall be suggested by the Executive Committee.

It was ordered that a copy of Downing's "Fruits and Fruit Trees of America" be furnished each experimenter free of charge.

At a committee meeting of the Executive, held on Wednesday morning, December 19th, it was resolved that the following groups of counties should in some way be considered in the selection of the three stations still open for location :

1. Huron, Bruce and Lambton.
2. The counties bordering on the St. Lawrence river.
3. Victoria, Peterboro', Ontario, Durham, West Northumberland.

It was further thought desirable to locate in the Niagara district, as soon as possible, another station for the special purpose of testing the most tender fruits.

A special meeting of the Board of Control was held at the Walker House, Toronto, at 10.30 a.m., on Friday, February 22nd.

There were present President Mills, Secretary Woolverton, Prof. Hutt and Messrs. W. E. Wellington, A. M. Smith and A. H. Pettit.

In response to a request from the Minister of Agriculture regarding a scheme for special experimental work in spraying, this subject was first discussed.

A scheme was presented by Mr. A. H. Pettit, and it was ordered that we recommend that the experiments be made in three divisions of Ontario, and in about ten ridings in each, as follows :

Division 1.—Essex, Kent, Norfolk, Haldimand, Monck, Welland.

Division 2.—South Ontario, Durham, Northumberland West, Prince Edward, Lennox, Frontenac, Leeds, Grenville, Dundas.

Division 3.—Lambton, Bruce, Central and South Grey, Simcoe.

It was recommended that the work be done thoroughly according to the following list of applications :

1. Sulphate of copper before the leaves appear.

2. Bordeaux mixture before the blossoms open.

3. Bordeaux mixture after the bloom falls.

4, 5 and 6. Bordeaux mixture at intervals of ten or twelve days.

The estimates of expenditure were then made and discussed.

It was further ordered that, if possible, it is considered by this Board desirable to secure the services of Mr. A. H. Pettit (1) to make preliminary visits, (2) to secure proper men to do the work and thoroughly instruct them, and (3) at the close of the season to visit the various places and prepare careful records of the results for publication.

At an adjourned meeting of the Board, held at the office of Mr. W. E. Wellington, the minutes of the previous meetings were read and approved.

Applications from various gentlemen desiring to be appointed as experimenters were read and considered.

The Visitation Committee was ordered to pay visits to the more desirable of these applicants during the coming season.

It was ordered that the Industrial Exhibition be asked to allow space to the Board of Control for a special exhibit of fruit from the Ontario fruit experiment stations, it being understood that the exhibit would not be in competition for prizes.

It was ordered that our experimenters be asked to make their best efforts in the forwarding of an exhibit to the Industrial.

The Secretary having placed upon the table extensive lists of varieties of plants and trees which, in his opinion, it is desirable to have tested at the various stations, it was ordered that the Secretary and Messrs. Hutt, Wellington and Smith constitute a committee to revise these lists previous to the stock being ordered.

REPORT OF SECRETARY.

Under this head the Secretary desires to report certain work that has been conducted under the authority of the Board of Control or of the Executive during the interim between the meetings.

In the first place lists of the new and old fruits, which had been prepared for the various stations, were approved by the committee appointed by the Board for the purpose of examining them. The Secretary then corresponded with the various experimenters concerning these lists, and after giving them a final revision, the stock was ordered from various nurserymen in Canada and the United States. Most of this stock was addressed to the Secretary, who paid all bills, and had them duly passed the customs and forwarded to the experimenters.

The list of trees and plants added in this way during the spring of 1895 is here given :

BAY OF QUINTE STATION.

Apples.

Akin.
Arkansas Black.
Arkansas Beauty.
Bank's Red Gravenstein.
Bishop Bourne.
Boiken.
Bogdenoff.
Carolina June.
Canada Reinette.
Cooper's Market.
Clayton.
Domine.
Early Harvest.
Esopus Spitzenburg.
Fanny.
Gibson.
Hastings.
Haskell's Sweet.
Jefferson.
John Richardson.
Lady Sweet.
Late Strawberry.
Missouri Pippin.
Mammoth Pippin.
McLean.
Palouse.
Paragon.
Peck's Pleasant.
Rawle's Janet.
Rome Beauty.
Red Canada.
Starr.
Shackleford.
Ulter's Red.
White Pippin.
Windsor Chief.
Washington Strawberry.
York Imperial.

Pears.

A. Desportes.
Ansault.
Angouleme.
B. S. Fox.
Beurre Giffard.
Brandywine.
Col. Wilder.
Dorset.
Duchess Precoce.
Dr. Jules Guyot.
Easter Beurre.
Fred Baudry.
Frederick Clapp.
Keiffer.
Lady Clapp.
Lucy Duke.
Louise Bonne.
Lincoln.
Manning's Elizabeth.
Margaret.
Pound.
P. Barry.
Summer Doyenne.
Souvenir d'Esperen.
Winter Nelis.
White Doyenne.

Plums.

Burbank.
DeSoto.
Fellemburg.
Huling's Superb.
Imperial Gage.
Jefferson.
McLaughlin.
Orange.
Prune d'Agen.
Reine Claude de Bavay.
Reine Claude Violette.
Smith's Orleans.
Victoria.
Wild Goose.
Willard.
Yellow Gage.

Varieties planted years ago by Mr. P. C. Dempsey, and omitted from First Report.

Plums.

Hudson River Purple Egg.
Shippers' Pride.
German Prune.
McLaughlin.
Beauty of Naples.
Monroe.
Reine Claude.
General Hand.
Niagara.
Niemetz.
Richard Trotter.
No. 22.
Saunders.
Damson.

Apples.

White Winter Parmain.
Powell.
King.
Hastings.
Royal Russet.
Reinette Grise.
Red Gilliflower.
Prinyea.
Willow Twig.
Baltimore.
Red Cathard.
Albury.
English Codling.
Ontario.
Plumb's Cider.
Swazie Pomme Gris.
Stott's Russett.
Arabka.

WENTWORTH STATION.

Grapes.

America.
Berckman.
Beacon.
Bell.
Black Delaware.
Cambridge.
Carman.
Dr. Collier.
Early Ohio.
Early Golden.
Elvicand.
Eumedel.
Gold Coin.
Grayson.
Geneva.
Janesville.
Lutie.
Louisiana.
Mason Seedling.
Montefiore.
Marion.
New Haven.
Opal.
Olita.
Ohio.
Presley.
Rochester.
Rommel.

PLUMS.

Abundance.
Burbank.
DeSoto.
Fellemberg.
Green Gage.
Grand Duke.
Huling's Superb.
Imperial Gage.
Jefferson.
McLaughlin.
Orange.
Ogon.
Prince Englebert.
Prune D'Agen.
Reine Claude de Bavay.
Reine Claude Violette.
Smith's Orleans.
Spaulding.
Satsuma.
Victoria.
Wild Goose.
Willard.
Weaver.
Yellow Gage.

CHERRIES.

Black Tartarian.
Coe's Transparent.
Early Purple.
Elkhorn.
Early Richmond.
Governor Wood.
May Duke.
Napoleon Bigarreau.
Ostheim.
Windsor.
Yellow Spanish

PEARS

B. S. Fox.
Col. Wilder.
Dorset.
Lady Clapp.
P Barry.

PEACHES.

Crosby.
Elberta.
Stewart.
Snow s Orange.

CURRANTS.

Black Naples.
Black Victoria.
Collin's Prolific.
Red Dutch.
Versailles.

SIMCOE STATION.

APPLES.

Anisim.
Bull's Seedling.
Bethel.
Bank's Red Gravenstein.
Cox's Orange Pippin.
Gano.
Gideon.
Good Peasant.
Hyslop Crab.
Hastings.
Isabella.
Jonathan.
Lubsk Queen.
Martha crab.
Minnesota Winter crab.
Magog Red Streak.
McMillan.
Nodhead.
Newton Pippin.
Orion crab.
Primate.
Parson's Sweet.
Peerless.
Paul's Imperial crab.
Picta Striata crab.
Quaker Beauty crab.
Red Canada.
Regel.
Starr.
Sally Brown.
Sweet Bough.
Sherwood's Favorite.
Salome.
Shackleford.
Sweet Longfield.
Telfer Sweet Crab.
Tetofsky.
Utter's Red.
Vargul.
VanWyck crab.
Whitney crab.
Wolf River.

PEARS.

Bessemianka.
Bergamot.
Baba.
Boussock.
Flemish Beauty.
Josephine de Malines
Winter Nelis.

STRAWBERRIES.

Beder Wood.
Banquet.
Gandy.
Greenville.
Henry Ward Beecher
Mary.
Noble.
Parker Earle.
Timbrell.

SOUTH-WESTERN STATION.

PEACHES.

Astrander Early.
Astrander Late.
Champion.
Dayton.
Early Richmond.
Fitzgerald.
Lorentz.

STRAWBERRIES.

Annie Laurie.
Australian.
Brandywine.
Brunette.
Belle.
Cyclone.
Eleanor.
Gardner.
Hilton Gem.
Jucunda Improved.
Laxton's Noble.
Latest of All.
Lord Suffield.
Laxton's No. 1.
Muskingum.
Marshall.
Noble.
Otsego.
Princess.
Staples.
Splendid.
Tennessee Prolific.
Watson.

SIMCOE SUB-STATION.

GOOSEBERRIES.

Crosby Seedling.
Chatauqua.
Columbus.
Champion.
Crown Bob.
Golden Prolific.
Large Golden Prolific.
Lancashire Lad.
Mrs. Whittaker.
Red Jacket.
Rumbullion.
Triumph.

MAPLEHURST CHERRY STATION.

EXPERIMENTER—L. WOOLVERTON, GRIMSBY.

CHERRIES.

Black Tartarian.
Black Eagle.
Belle de Choisy.
Belle Magnifique.
Besserabian.
Cleveland.
Centennial.
Coe's Transparent.
Downer's Late.
Early Richmond.
English Morello.
Early Purple.
Elton.
Empress Eugenie.
Governor Wood.
Griotte du Nord.
Ida.
Kay's Morello.
Late Duke.
Lutovka
May Duke.
Montmorency.
Napoleon Bigarreau.
Olivet.
Ohio Beauty.
Royal Duke.
Rockport.
Reine Hortense.
Sklanda.
Schmidt's Bigarreau.
Tradescant Black.
Windsor.
Wragg.
Yellow Spanish.

DWARF PEARS.

Anjou.
Ansault.
Andre Desportes.
Beurre Easter.
Belle Lucrative.
Bosc.
Boussock.
Beurre Giffard.
Col. Wilder.
Clairgeau.
Dana's Hovey.
Duhamel du Monceau.
Frederick Clapp.
Hoosic.
Hardy.
Jones.
Josephine de Malines.
Lady Clapp.
Lawrence.
Lawson.
Margaret.
Manning's Elizabeth.
P. Duchess.
P. Barry.
Reeder.
Souvenir du Congres
Superfin.
Souvenir d'Esperen.
Summer Doyenne.
Sheldon.
Urbaniste.
Urbaniste.
Winter Nelis.
Wilder Early.

PEACHES.

Barnard.
Beer's Smock.
Bowslaugh Late.
Crosby.
Champion.
Elberta.
Garfield.
Hill's Child.
Hyne's Surprise.
Jacque's Rareripe.
Longhurst.
McConnell Seedling.
New Prolific.
Reeve's]Favorite.
Smock.
Stephen's Rareripe
Tyhurst.
Wonderful.
Wheatfield.
Yellow St. John.

APRICOTS.

Alexander.
Alberge de Montgamet.
Early Moorepark.
Gibb.
Nicholas.
Peach.
Red Mascallin.
Scoboloff.
St. Amorose.

PLUMS.

Abundance.
Arch Duke.
Burbank.
Bradshaw.
Diamond.
Fellemberg.
German Prune.
Gen. Hand.
Grand Duke.
Green Gage.
Gueii.
Huling's Superb.
H. R. Purple Egg.
Imperial Gage.
Jefferson.
Large Golden Prolific.
Moore's Arctic.
Monarch.
McLaughlin.
Ogon.
Orange.
Purple Egg.
Peter's Yellow Egg.
Prince of Wales.
Prince Englehert.
Quackenbos.
Reine Claude.
Satsuma.
Smith's Orleans.
Shipper's Pride.
Spaulding.
Victoria.
Willard.
Wild Goose.
Washington.
Weaver.
Yellow Egg.
Yellow Gage.

BURLINGTON STATION.

BLACKBERRIES.

Agawam.
Early Cluster.
Early Harvest.
Erie.
Gainor.
Hopkins.
Kittatinny.
Smith's Giant.
Snyder.
Stone's Hardy.
Taylor.
Western Triumph.
Wachusetts.

RASPBERRIES.

Cuthbert.
Eureka.
Golden Queen
Gault.
Hilborn.
Highland Hardy.
Marlboro'.
Older.
Palmer.
Progress.
Royal Church.
Reliance.
Shaffer's Colossal.
Success.
Thompson's Early.
Turner.

GOOSEBERRIES.

Pearl.

GEORGIAN BAY STATION.

PLUMS.

Arch Duke.
Abundance.
Bickley.
Burbank.
Cheney.
Diamond.
Fellemberg.
German Prune.
Gen. Hand.
Gueii.
Hugh's Seedling.
Hungarian Prune.
Huling's Superb.
H. R. Purple Egg.
Jefferson.
Large Yellow Prolific.
Montreal Yellow.
Moore's Arctic.
Monarch.
McLaughlin.
Orange Prune.
Peter's Yellow Gage.
Prune d'Agen.
Prince of Wales.
Quackenbos.
Reine Claude de Bavay.
Saunders.
Sand or Wyant.
Shipper's Pride.
Spaulding.
Stanton.
Ungarish Prune.
Wyant or Sand.
Wild Goose.
Weaver.
Willard.
Yellow.
Yellow Gage.
Yellow Egg.

PEARS.

Beurre Bosc.
Clapp's Favorite.
Duchess d'Angouleme.
Doyenne Boussock.
Howell.
Idaho.
Josephine de Malines.
Kieffer.
Lawrence.
Sheldon.
Superfin.
Souvenir du Congres
Winter Nelis.

PEACHES.

Bowslaugh's Late.
Crosby.
Champion.
Elberta.
Hale's Early.

VISITS TO EXPERIMENTERS.

A visit was paid by the Secretary in the month of January, 1895, to Mr. A. W. Peart, Freeman, an applicant for the experiment station in that district.

In the month of May, Mr. Hutt and the Secretary visited Mr. Martin Burrill, President of the Louth Agricultural Society, who was an applicant for that district, and in July they visited Mr. E. B. Stevenson, strawberry specialist at Freeman, and Mr. S. Spillett, gooseberry specialist, Nantyr, who were applicants for experimental work with these fruits respectively.

In the month of August a visit was made by Prof. Hutt and the Secretary to the county of Bruce. The applicants seen and considered in that county were Mr. A. E. Sherrington, of Walkerton, and Mr. J. H. Wismer, of Port Elgin. Prof. Hutt then visited Mr. John Mitchell, our experimenter in the Beaver Valley, and Mr. G. C. Caston, our experimenter at Craighurst.

Early in September Prof. Hutt and the Secretary proceeded east of Toronto, visiting the following applicants for experimental work: Mr. J. L. Huggard, Whitby; Mr. E. C. Beman, of Newcastle, and Mr. Harold Jones, of Maitland.

Later on Prof. Hutt completed the tour of visitation to the other stations in western Ontario, a detailed account of which he will present to you. He will also give you in detail our united recommendations with regard to the appointment of new stations.

EXHIBIT AT INDUSTRIAL EXHIBITION, TORONTO.

On the 9th of September your Secretary visited Toronto to superintend the experimental exhibit, which was quite large, covering over six hundred plates. He was present to answer inquiries during the Monday, Tuesday, Wednesday and the Friday of that week. He secured assistance in setting up the exhibit from Messrs. A. H. Pettit, of Grimsby; A. M. Smith, of St. Catharines, and W. H. Dempsey of Trenton.

The following is a report of the exhibit:

In accordance with the instructions of the Executive Committee at Guelph, August 27th, the Secretary corresponded with the experimenters concerning an exhibit of varieties of fruits from each station at the Industrial Fair, and, as a result, a very large and interesting exhibit was secured.

Our grape experiment station at Winona contributed 111 varieties of grapes, besides some choice apples and pears; the Bay of Quinte station contributed 150 varieties of apples and pears; the Georgian Bay station contributed forty-one varieties of apples, thirteen of pears, besides some plums and peaches; our southwestern station in Essex contributed twenty-six varieties of peaches, besides apples, grapes and pears; A. M. Smith, St. Catharines, contributed twelve varieties of peaches, seven of pears, and also secured for us from Mr. Seymour Parnell, of St. Catharines, sixteen varieties of Russian apples which had been secured through the agency of the Fruit Growers' Association some years ago. In addition to these, the Secretary contributed 150 varieties of fruits of various kinds.

A large display sign of cloth was printed containing the words "Exhibit of the Ontario Experimental Fruit Farms," and this was hung on the wall over the exhibit. Besides this the name of each station, giving also the name of experimenter and his specialty, was printed on large sheets and posted over each exhibit. The display covered nearly the whole of two sides of the fruit building.

Our exhibit attracted much attention from all visitors, many of whom were interested in knowing the varieties of fruits which succeed best in the various localities of Ontario. It was also of great interest to other exhibitors who naturally looked to the experimental collection to verify the correctness of their own nomenclature.

This suggests a very important work devolving on us, namely, the correction of misnomers which exist throughout our country. To do this, it will be necessary that our exhibit be carefully supervised and the names verified, comparing the varieties, if necessary, with reliable descriptions. In this instance so enormous was the task devolving upon the Secretary in placing and arranging six or eight hundred plates of fruit, that, even with the assistance of Messrs. A. M. Smith, W. H. Dempsey and A. H. Pettit during a portion of the time, it was impossible to give much time to the verifying of names of the less common varieties and the comparing of samples of the same variety as grown at our different stations which will be a most important part of our work in the future.

In order that our exhibit be as directly educational in its nature as possible, I would suggest that in 1896 we again make an exhibit and that we observe the following points as the result of our experience in 1895 :

1. That each experimenter show a complete collection of his specialty, but of other fruits only samples of varieties of exceptional merit or of special interest.

2. That each exhibit, as far as possible, be opened and set up by the experimenter showing it.

3. That each experimenter be paid for his exhibit at the rate of ten cents for each correctly named variety set up at the Fair under the direction of the Executive who will have power entirely to reject plates of inferior samples.

4. That each experimenter have his expenses paid to and from the Fair in order to set up his collection and label it correctly.

5. That the superintendence of the whole be in the hands of the Executive Committee, with power to engage assistance, if necessary, in keeping the exhibit in order, and in answering questions relating thereto.

Inquiries were constant from exhibitors concerning the identification of varieties, and also from intending planters concerning the best varieties to plant in their respective localities.

EXPERIMENTAL SHIPMENT OF APPLES.

The great importance to Canadian fruit growers of opening up new markets, more especially for our apples, has led us to consider the possibilities of shipping to Australia. Apples were shown at the World's Fair from New South Wales, and the same country ships apples to Great Britain in good condition. Surely, therefore, we can reach Sydney with Canadian apples.

The fact that autumn in Canada is spring in Australia, and that these markets are bare of apples in October, November and December, led us to make still farther enquiries concerning Australian markets, and in response your Secretary received the following information in a letter from Mr. J. S. Larke, the commercial representative of Canada, at Sydney, dated July 16th, 1895 :

SYDNEY, N. S. W., July 16, 1895.

"In regard to the shipment of fruit here, the result would be very problematical. They do not use apples in this country as we do in Canada, mainly because of the expense and on account of the cheapness of meat leading to a much larger use of it than with us. This is the apple season of this country, the fruit being brought from Tasmania. I yesterday bought a case of cooking apples, hard and green. These cases contain, nominally, forty pounds of apples, generally less. Yesterday the case I bought cost six shillings and sixpence delivered at the house, and these were brought from a wholesale house. This is nearly two dollars and a half per bushel. The market prices, I observe, are somewhat less than the above, but I have never succeeded in buying at the market prices, and presume that they are the prices paid by the wholesale dealer. These apples will soon be out of season, and apples shipped from Ontario in November would reach here when the market would be bare of Australasian fruit. They would, however, have to meet the competition from California. Last year nearly 3,000 cases were sold from that country. The prices realized would run from eleven to fifteen shillings per bushel. This price is too high for a large consumption. There

is at present a duty of one shilling per bushel, which will, perhaps, be removed upon the first of January next, although this is exceedingly doubtful. I cannot tell you what you would be able to lay down a car of apples from Grimsby to Sydney at. You will be able to ascertain from a C. P. R. agent, who would perhaps give you a low rate on a trial shipment. In competing with California you would be competing with apples with no overland freight of any extent to pay, but I think a shipment of such apples as the Northern Spy would bring a higher price than the California product. There is little doubt that they would stand the journey and reach here in good condition. I think, however, that I would ship them in cases containing a bushel each. Barrels are expensive for shipping by water, as six of them make a ton of forty cubic feet. I rather expect it would be difficult to get the Government to pay the expense ot a shipment of this kind, as they do not appear to have too overflowing a treasury just now. My services will of course cost nothing.

"In addition to what I have stated there would be some charges for cartage, dock charges, handling, etc., but I think that if put up in bushel cases as before mentioned, I might estimate the expenses to be something like this: Duty, one shilling; handling, cartage, commission, etc., one shilling; freight, six shillings. If they can be sold at twelve shillings a bushel this would leave a very narrow margin; if they could bring fifteen shillings that would be very much better. If you could make arrangements for a portion of a cargo I think it would be better than for a whole carload. It would also be advisable, if the experiment is decided upon, that I should be advised as early as possible, to prevent a larger quantity of Californian apples being ordered than might otherwise be the case. As a quantity of apples are pretty sure to be sent to British Columbia, a few cases might be sent here, as the steamer would take, I think, 100 cases at a very little higher rate than 1,000."

This letter, having been considered at a special meeting of the Board of Control, it was decided that the matter was of sufficient importance to Canadian fruit growers to make the experiment on a small scale, so that if successful growers might afterwards undertake it in commercial way.

Your Secretary was instructed to endeavor to carry out the wishes of the Board in this matter, and in response to his enquiries a letter was received, dated August 28th, informing him that owing to the steamer Warimoo being disabled her sailing date in October would not be taken, and that therefore any shipments would have to be made in September or November. The company would carry one hundred cases or barrels from Toronto to Sydney at the rate of $1.50 per 100 pounds. It was also stated that cold storage space for the apples could be supplied in the steamer if advised in advance. Another letter, dated September 30th, conveyed the information that the railway company could not afford to run a refrigerator car with so small a load as that proposed to be sent.

Correspondence was had with several leading growers, and with some difficulty a shipment of one hundred and fifteen cases extra selected apples was made up. Some growers refused to join, believing the result would only be a total loss of the fruit, even if the freight was guaranteed. One firm of growers and shippers, in declining to send a consignment, pointed out that several attempts had been made to ship apples across the equator, and that none had been successful. The C. P. R. steamers had carried apples to Hong Kong, but while the fruit arrived in apparently fair condition so far as appearance went, it was found to be dry and pithy, and with scarcely any flavor.

The following is the list of varieties shipped: Baldwins, Greenings, Spy, King, Fameuse, Cranberry Pippin; and all were carefully wrapped in tissue paper and packed firmly in apple cases holding between fifty and sixty pounds each.

This shipment left Hamilton on the 17th of October, your secretary paying the freight in advance, in response to a letter from the C. P. R. agent at Hamilton. It was found necessary by the railway company to have the cases strapped with iron at both ends, which added $4.60 to the cost of transportation.

In accordance also with the instructions of the Board of Control, joint action with the Ontario Fruit Growers' Association was taken in order to facilitate an experimental shipment of tender fruits, such as pears, tomatoes, grapes, peaches, plums, etc., to Great Britain in the cold storage compartments which were promised by the Dominion on the Allan Line of steamers. A large number of shippers in the Niagara district contributed to this shipment, and a car was filled with the choicest products of the Niagara district. But owing to the unfortunate collapse of the cold storage on shipboard, the fruit arrived in a wasty condition, and therefore the experiment was a failure. Next year better results are expected.

The result of the shipment to Australia is very interesting to Canadian apple growers, because it proves the possibility of a most important outlet for out finest grade of Ontario apples in seasons of abundance. When bushel cases can be sold in Sydney as high as fifteen shillings each the price of a barrel of No. 1 apples in Liverpool, and with freight charges of only about four shillings per case, it evidently only needs proper cold storage compartments to make this market the best in the world for Canadian apples.

Report of Mr. J. S. Larke.

Following is the report made by Mr. J. S. Larke, Commercial Agent of the Government of Canada, at Sydney, N. S. W., and dated December 18th, 1895.

I deemed that the fullest information as well as monetary returns were the object of the experimental shipment of apples. In order to secure this I put them into the hands of F. A. Winter & Co. Mr. Winter is a Canadian from Preston, who has been in Australia for some years and is devoting himself to handling Canadian goods and knows something about Canadian apples. He accepted them at sixpence per case. The ordinary commission for selling is seven and a half per cent., but this is disposing of them quickly and would not secure the facts that were obtained by handling single cases, so as to get the knowledge of the relative value of each variety of apples. I can state that Mr. Winter did the work thoroughly. I met him in the markets before six o'clock in the morning, before the arrival of the fruit, and personally know he visited the proprietors of the leading fruit shops and hotels to get customers.

I had intended to use the shipment as an advertisement for Canada had they arrived all right, but owing to the uncertainty as to what their condition might be, I had to go cautiously and simply had notices of their coming inserted in the leading papers. I may say Mr. Winter's commission at sixpence per case would have been but little over half the regular commission had the fruit arrived in good condition, and returns about two shillings per day for the time he devoted to the work after deducting car, bus and ferry fares. His full report tells the story, but I may add a note or two.

Codling Moth. The apples were well selected, but I found one or two cases of codling moth. There is no inspection law in this city as yet, but there may be next year and there is in one or two of the other colonies now. As these apples should be eligible to be reshipped to the other colonies, great care would have to be exercised in this respect in future shipments.

Size. As Mr. Winter points out, the shipment should be a portion medium size, another the largest, say at the rate of two cases of the former to one of the latter.

Color. This is of the utmost importance, even more so than flavor. The fruit should be a bright red. The Greenings were mistaken for cooking apples and although they had retained their flavor better than the other varieties, they would not bring a top price. The Cranberry Pippin is the type that this shipment has proven to be suited to this market.

Wrapping. The apples should be wrapped, it prevents abrasion of the skin and thus decay of the fruit. Manilla is better than the tissue paper. Some dealers here use the grease and waterproof paper used for packing butter, a sample of which I enclose. It has the advantage of preventing a decayed apple from infecting sound fruit and when fruit is shipped on deck and liable to be sprayed with salt water would be useful, but it is expensive and more difficult to handle than manilla, which has in this shipment answered the purpose well. The best shippers here wrap the ends of the paper around the stem and form a little cushion which assists in preventing the bruising of the apple.

Cases. The consensus of opinion is in favor of ventilated cases, either by boring holes as indicated by Mr. Winter, or by having the tops and sides of two pieces which would not quite meet. It would have been well if a portion of the shipment had been sent in ventilated cases.

Shipment The fruit, evidently, was carefully handled by the C. P. R. The steamship also devoted special care by putting it in an insulated chamber, where the temperature would be fairly even and kept an electric fan at work ventilating it. It was the hot air of the tropics that was thus pumped in and the tight cases neutralized even this. Thus for two weeks the apples steamed in their boxes, and to such an extent that the odor and flavor of the boxes had thoroughly permeated the fruit and, as we all thought, ruined them. This went off upon exposure to the air for a time but the fruit had become dead and to a large extent insipid. The favorite place for carrying fruit here is on the upper deck where it is simply covered with an awning. For short voyages this does well but in a long voyage the fruit is more liable to bruising by the rolling of the ship and to loss in a storm. The Warrimoo and Miowera have plenty of insulated chambers and refrigerating apparatus, and I think the fruit can be successfully carried in these chambers with the temperature maintained a little above freezing point. In a few months, shipments of apples will be made from Tasmania to Vancouver. I propose to get the steamships to test different methods of carrying fruit and I will be able to report the result to you.

The Future. Granting that the apples can be brought here in first-class condition, of which there is not much doubt, I think that eight thousand cases of apples like the Cranberry Pippin, carefully selected, could be sold at from ten to fifteen shillings per case. They would have to be landed by the steamer reaching here in November. The weather then is cooler, the markets barest of fruit. Whether this will pay will depend on the price in Canada and the rate of freight obtainable at the time.

I must thank you for the case of Cranberries and case of Fameuse sent me. They suffered like the others, but the Fameuse came out better than I feared. I had been boasting to Australians of the apples I proposed to give them when they came out. Neither variety were in the condition I would like to have had them, nevertheless I secured a quantity for distribution that were just a little bit better than any other fruit in the market. I am sorry the result is not what we should like, but it is not for want of attention at this end. Between the arrival and the sailing of the steamer, I am pretty well rushed, but Mr. Winter made up for what I could not do.

I am writing this in a hurry to catch the steamer leaving to-day, but I shall be glad to hear from you upon it and give any information respecting this or future shipments I can.

I beg to enclose a sight draft on London for eleven pounds, six shillings, which is the net receipts of the apples less two and sixpence exchange and one penny stamp duty.

ACCOUNT SALES BY F. A. WINTER & Co.

No. 1.

SYDNEY, N. S. W., December 16, 1895.

J. S. LARKE, Esq., Sydney, N. S. W.:

Account Sales of Canadian Apples, on account of Messrs. Woolverton & Cline, Ontario, Canada.

Cash received--						
Account, L. Woolverton	£15	4	0			
" G. W. Cline	7	3	0			
				£22	7	0
Cash paid—						
Duty, 113 cases @ 1s. per case	£5	13	0			
Commission, 113 cases @ 6d. per case	2	16	6			
Wharfage " @ 1d. "		9	5			
Cartage " @ 2s. 6d. per ton .....3 tons		7	6			
3 men, 1 day, picking over apples		18	0			
1 man, part of day, picking and repacking		2	0			
Carting rubbish away		2	0			
Market dues		5	0			
Space for repacking		5	0			
				£10	18	5
				£11	8	7

F. A. WINTER.

No. 2.

SYDNEY, N. S. W., December 14th, 1895.

Account Sales of Canadian Apples, on account of L. Woolverton, Esq., Grimsby, Ontario, Canada.

3	cases	Cranberry Pippins, extra, @ 15*s*	£2	5	0			
1	"	" @ 12*s*		12	0			
1	"	" @ 11*s*		11	0			
3	"	" @ 10*s*	1	10	0			
7	"	" @ 9*s*. 6*d*	3	6	6			
1	"	" badly spotted, @ 2*s*. 6*d*		2	6			
1½	"	" "		4	0			
						£8	11	0
¼	"	Kings	£0	4	0			
							4	0
1	"	Baldwins, extra, @ 11*s*	£0	11	0			
9	"	" @ 10*s*	4	10	0			
1½	"	"		14	6			
15	"	" badly spotted		4	6			
						£6	0	0
9	"	bad, mixed, to jam factory @ 1*s*					9	0
		Total receipts				£15	4	0

Of 35 cases of Baldwins.....only 11½ cases were marketable.
" 27 " Cranberry Pippins " 15 "
" 1 " Kings " ¼ "
" 63 " all kinds " 26¾ "

No. 3.

SYDNEY, N. S. W., 14th December, 1895.

Account Sales of Canadian Apples, on account of G. W. Cline, Winona, Ont.

2	cases	Greenings @ 9*s*	£0	18	0			
5	"	" @ 6*s*	1	10	0			
						£2	8	0
10	"	Baldwins @ 7*s*	£3	10	0			
						3	10	0
1½	"	" badly spotted, @ 2*s*. 6*d*	£0	5	0			
10	"	" half rotten, @ 1*s*		10	0			
							15	0
		Total				£7	3	0

Out of 24 cases of Baldwins only 10 cases marketable.
" 18 " Greenings " 7 "
" 8 " N. Spy " 1½ "
" 50 " all kinds " 18½ "

MR. WINTERS' REPORT.

SYDNEY, N. S. W., December 14th, 1895.

J. S. LARKE, Esq.,
Commercial Agent of the Canadian Government,
The Exchange, Sydney, N. S. W.

DEAR SIR,—I sold the last of the trial shipment of Canadian apples to-day and enclose account sales with statement of the proportion of the various kinds of apples that arrived in marketable condition. The item of duty, one shilling per bushel, would not occur in future shipments, as the duty on apples will be removed on the first of January next. The result from a financial point of view has not been satisfactory, but as an experiment the shipment has been of undoubted value and proves conclusively that under favorable conditions apples can be shipped from Ontario and sold to advantage here in Sydney, while the experience gained by this shipment may serve to prevent more serious losses in the future.

In accordance with your request I will endeavor to report fully the result of my experience in connection with the apples forwarded by Mr. L. Woolverton, of Grimsby, and Mr. G. W. Cline, of Winona, Ontario, and also give them the benefit of any knowledge obtained by inquiries from those who have been in the habit of importing American apples *via* San Francisco.

As soon as you informed me in regard to the varieties and quantity of each that were to arrive, I made enquiries as to the prospects for disposing of them, and soon learned that there was a very strong prejudice against American apples on the ground that, although they might be ever so good looking outside, so many of them were rotten at the core and tasteless that, as one shopkeeper said, "If there were any other decent apples in the market I would never buy an American apple, for there is no satisfaction to anybody in selling them." The wholesale men had the same objection, and I heard of several who had lost large sums of money on apples sent to them by agents *via* San Francisco and of whole shipments being sold in stacks on the wharf at from sixpence to two shillings per case (bushel), and a shipment that arrived a month ago had not turned out very well. To each one I explained that as the climate of Ontario was much colder than that of California, the apples grown there were better in flavor and keeping qualities than those from San Francisco, just as the apples from Tasmania are superior to those grown here in New South Wales.

It appears that for some years there has been an average of three monthly shipments every year from San Francisco. The last for this season (1,000 cases) arrived two days before the Canadian apples and I went down to the wharf to see them and noticed that all the cases had about six ¾-inch auger holes in each side for ventilation. On inquiry I found that this was the first shipment sent with ventilated cases, and it turned out better than previous ones. They had come out on the main deck instead of in the hold and had been stacked with laths between the cases.

The Warrimoo arrived on Tuesday evening about five o'clock, and I endeavored to see the apples at once but they were not landed until next morning. I opened two cases, and found the temperature among the apples very high, while many of them were completely decayed, those that were sound had a very decided pine pitch flavor, sufficient to destroy the natural flavor of the apple. No time was lost in passing entries and having them removed to the Fruit Exchange, where I had them picked over, beginning with the Cranberry Pippins, many of which had a parboiled appearance outside, even when quite sound at the re, and gave evidence of having suffered from intense heat, while many were completely gone. For fear that those that were sound would go shortly after exposure to the atmosphere, I sold seven cases at 9*s.* 6*d.* each and three at 10*s.* that evening. Finding next morning that with exposure the flavor improved, I put up the price, selling one case at 11*s.*, another at 12*s.* and one at 15*s.*, leaving two cases left, which I sold at 15*s.* on Friday, a price far above any other apple in the market. The sound Cranberry Pippins stood repacking and exposure well, and those who bought the first lots came back for more. The opinion was freely expressed that they were the finest looking apples ever seen here. I have since seen them sold retail for threepence each.

The Baldwins sent out by Mr. L. Woolverton were highly colored, well selected and graded, and I succeeded in selling them all for 10*s.*, except one case of extra fine ones, for which I obtained 11*s.* I found a prejudice against Baldwins as having a tendency "to go sleepy" as they say here.

The single case of Kings were in very bad condition; there was not a dozen perfect apples in the case, so there was really no opportunity to test the market with them, as I had to put in a number of spotted ones and a few odd Cranberry Pippins to make up the part case sold for 4*s.*

Of the eight cases of Northern Spys sent out by Mr. Cline, only one and a half cases were in marketable condition when opened, and even they soon became spotted so that 10*s.* was all that could be obtained for the lot. Mr. Cline's Baldwins were inferior to Mr. Woolverton's in size and color, and were not so well graded, the colored tissue paper used was saturated and difficult to remove from the apples, and in some cases this colored them.

The Greenings are not well suited to this market, as there are at present cheap local apples for cooking purposes, and for dessert or table use the people prefer a highly colored apple like the Cranberry Pippin. The Greenings were difficult of sale and too ripe to keep long, so after disposing of two cases at 9*s.*, one of which went to the Hotel Australia (of which Mr. Moore, late of Toronto, is manager), I was obliged to clear them out on Saturday at 6*s.*, as they were getting soft and mealy.

The apples were stored in an insulated chamber between decks, near the stern of the Warrimoo, which, judged by the apples when unpacked, must have become very heated. The almost airtight cases in which they were packed prevented ventilation among the apples, and when once they started to decay generated considerable heat.

In conversation with the chief officer of the Mariposa, who has been carrying apples for years from San Francisco, he said that on that ship the best places to stow apples were either on deck or at the bottom of the hold near the bow, below water level, the coldest part of the ship. The ventilation of the cases and circulation of the air he looked upon as an important matter.

Apples sent from here and Tasmania to England are usually placed in cool storage with an even temperature all the way and stand the trip across the line and through the Red Sea very well when carefully packed. I do not see why similar arrangements could not be made for bringing them from Vancouver here.

The best time for a shipment of Canadian apples to arrive would be the first half of November or earlier, were it possible, just before the stone fruit comes in or any local apples are ready to sell. It will be seen from the enclosed clippings from the Sydney *Herald* of December 13th and 14th, that there is quite a variety of fruit on the market now, including local apples at from 3*s.* to 7*s.* per gin case (five pecks).

In conversation with several wholesale fruit dealers to-day, they told me that if apples like the Cranberry Pippin were landed here in fair condition in quantities to meet the demand, there would be no doubt of their supplanting the San Francisco apples altogether. The freight from San Francisco is about 3*s.* 6*d.* per case, or very nearly as much as from Grimsby to Sydney, and the long rail journey did not appear to affect carefully packed apples in the least. In boring holes in the sides of cases to ventilate

them, care should be taken to have them come, as far as possible, between the rows of apples, so that the edge of the hole will not chafe the apples, and special instructions should be given at all points of reshipment to see that the top of the case is kept uppermost.

Apples as carefully selected, graded and packed as those sent by Mr. Woolverton, with anything like fair treatment on board ship, would, I think, arrive in good condition, particularly if the cases were ventilated and cleats nailed on the top and side of cases to prevent them being stowed too close together. The Canadian cases are somewhat larger than those sent with apples from San Francisco. The relative dimensions are as follows: Canadian case, inside measurement, 11¾ x 11 x 21; American cases vary in width from 9½ to 10 5-6 ins. with a depth of 12 and length of 20½ inside measurements. However, I would recommend keeping to the size case used for this shipment, as it allows for the packing at the bottom of the case.

Nearly 6,000 cases of apples have arrived this season from San Francisco, about 1,000 in October, 2,995 in November and 1,000 in December. The quantity shipped has been falling off of late years, as local apples are being kept longer and brought in earlier than formerly.

In regard to size of apples shipped, there is a limited sale here in Sidney for very large apples, but well colored apples, evenly graded, of the size of the second grade of Cranberry Pippins, would meet with the readiest sale, as all eating apples are sold retail by the dozen, and only a few shops can afford to buy apples that go so few to a case.

Should any further information be desired, it will afford me pleasure at any time to answer inquiries and for my own satisfaction I should like to know as early as possible whether there is likely to be shipment next year. As a native of Ontario I have taken a deep interest in this experiment, and have gone to a lot of trouble, endeavoring in every way to create for Canadian apples a distinct place on the market as being different to the Californian apples, and should any more be sent out, will be pleased to do what I can to have them disposed of to the best advantage. It is to be regretted that the trial shipment has not paid those who were plucky enough to make the venture, and I trust that future shipments may more than compensate for all loss on this.

Yours faithfully,

F. A. WINTER.

P.S.—It should be noted that the prices quoted in the newspapers were the prices asked, not necessarily obtained, as at time of quoting none of Mr. Cline's apples had been sold.

F. A. W.

QUOTATIONS FROM SYDNEY "HERALD."

December 13th, 1895.

S. M. "HERALD" FRUIT MARKETS.

The market was heavily supplied with all kinds of summer fruits, especially apricots, plums and peaches. Cherries were also in abundance. The demand generally was slow, and prices all round ruled easier. The jam companies continue to operate freely, being purchasers of large quantities of apricots and plums. Strawberries ruled decidedly easier. A cable published in the *Herald* about a month ago, stated that a trial shipment of apples had left Canada to test the Sydney market. The shipment consisted of 115 cases, and arrived yesterday at ex-Warrimoo (s.). They were forwarded to Sydney on account of Mr. Woolverton, who is the Secretary for the Fruit Growers' Association of Grimsby, Ontario, Canada. The names of the different kinds of apples were Cranberry Pippins, Greening, Baldwins, Kings, and Northern Spy. The apples were, generally speaking, of a large size, and well colored. They were grown at Grimsby, and had to be carried three thousand miles by rail before being shipped at Vancouver. The Cranberry Pippins arrived in good order, and realized 15*s.* per case. The other kinds were more or less damaged, and it is doubtful whether they will pay expenses. The market at present is not a very good one for apples on account of the large quantities of local fruit offering.

Current quotations are:

Lemons.—Prime, 11*s.*, to 13*s.*; choice, 14*s.* per gin-case.

Apples.—Small, 3*s.* to 3*s.* 6*d.*; good, 5*s.* to 6*s.*; Nelsons, choice, 7*s.* per gin-case.

Canadian Apples.—Cranberry Pippins, 15*s.*; Greening, 10*s.* to 12*s.*; Baldwin, 10*s.* to 11*s.*, and Northern Spy, 10*s.* per case.

December 14th, 1895.

The markets were heavily supplied to-day with all kinds of seasonable fruits. The demand was much brisker than it has been for some time. Peaches were not very plentiful, and consequently prices ruled firmer. There was an improved demand for Melbourne cherries, which realized higher prices. The local article sold much better at late current rates. Lemons were in good request at a slight reduction in price. Japanese and black plums commanded a fair amount of attention at slightly improved prices. Apricots were not in such heavy supply, and the quality, generally speaking, was much better, as also were prices. There was no sale for gooseberries. Bananas met with good demand, but prices still remain at a low ebb, owing to the large quantity of other fruits offering. Watermelons were on the market, and found fairly good sale at 9*s.* to 10*s.* per dozen, and passion fruit ruled a shade easier. Mr. F. A. Winter, who was the agent for the Canadian apples, which were on the market yesterday, stated to-day that the shipment will prove a loss to the senders, owing to the bulk arriving in bad order. The Cranberry Pippin was the only apple that carried well; the bulk of this class arrived in splendid condition, and, being a beautifully colored apple, is eminently suited for this market, as the agent stated that they have already been sold.

FINANCIAL STATEMENT.

Our finances are entirely under the control of the Department of Agriculture. Accounts are sent to me, and certified correct; then, if approved by the Provincial Auditor, they are paid by cheque from the Treasury Department. I have, however, kept a careful memorandum of payments, and here present it for your consideration.

Receipts.

Government grant	$2,000 00

Expenditures.

Allowance to experimenters	$725 60
Stock	337 25
Salary of secretary	200 00
Travelling expenses of official visitors to stations and proposed stations	150 42
Fruit exhibit at Industrial Fair	70 70
Freight and duty	68 84
Camera and supplies	66 82
Board meetings	63 25
Books for experimenters	55 10
Experimental shipment to Liverpool	35 33
Experimental shipment to Australia	105 94
Postage	21 85
Nozzles for spraying	14 00
Printing and stationery	12 50
Committees	6 50
Small items	2 00
Balance (not drawn)	63 90
	$2,000 00

FUTURE PLANS.

Among the new features of our work for the year 1896, I may mention that of putting up samples in preservative liquids for exhibition at the Industrial, and afterwards for forwarding to the Ontario exhibit at the Imperial Institute, in London, England. The small fruits of the early summer, such as strawberries, cherries, gooseberries. etc., cannot be shown at the Industrial in any other way, and it is the wish of the Department that fresh samples be forwarded to the Imperial Institute.

In order to accomplish the best results in his work, the Secretary needs first a microscope for closer examination of fungi and insects sent in by experimenters. This need not cost over twenty-five or thirty dollars. And second, a camera, for taking photographs of fruits. One costing about forty dollars would do this work. This is one of our most important undertakings, namely, the preparing of photogravures of the fruits grown by our experimenters, which shall show our fruits as they really are, without the least exaggeration.

THE REPORTS FROM THE STATIONS.

The work of describing varieties is being pretty well attended to by all our experimenters, and indeed it is about the only thing we can do at first, viz., to describe all old varieties already well tested; but the most important part of our report in the future will be the yearly experiments with different fruits which are to be embodied in the STATION RECORDS. The attention of all our experimenters must therefore be especially called to the blank forms provided to show the results of these yearly experiments.

APPLES—Descriptive List of Varieties.

Tested at Bay of Quinte Experiment Station: W. H. Dempsey, Trenton, Experimenter.

Habit: S, Spreading; U, Upright; D, Drooping. *Cavity*: S, Shallow; N, Narrow; D, Deep; B, Broad. *Stem*: Length; tenacity to tree.
Size: S, Small, less than 1½ inches in diameter; M, Medium, 1½ to 3½ inches in diameter; L, Large, over 3½ inches in diameter.

Number.	Variety.	Origin.	Tree.		Fruit.		
			Habit.	Age of bearing in years.	Size.	Form.	Color of skin.
1	Albury	Albury, Prince Edward	S	8	L	round, ovate	yellow.
2	Alexander	Russia	S	6	L	round, ovate, conical	greenish-yellow, russett dots, streaked with red, or splashed.
3	American Golden Russet		U S	8	M	ovate	golden yellow, covered with thin russet, numerous grey dots.
4	Benoni	Dedham, Mass	U S	10	M	oblate, conical	rich yellow, blushed with red in sun.
5	Ben Davis	America	S	5	M L	roundish, ovate	yellow striped and splashed with red.
6	Baldwin	Massachusetts	S	10	L	roundish	yellow, shaded, splashed with crimson and red.
7	Beauty of Kent	England	S	8	L	roundish, ovate	yellow, tinged with green, shaded with red.
8	Bailey Sweet	New York State	S	6	L	roundish, conical	yellow, shaded with red, russet dots.
9	Blenheim Pippin	Oxfordshire, England	U S	10	L	round, oblate	orange-yellow, streaked and splashed with red, large russet dots.
10	Bonum	Squire Kennedy, Dandson Co., N.C.	U	5	M	oblate	yellow, shaded with deep crimson strips and splashes of dark red, light dots, russet around basin.
11	Cabashea		U S	10	L	round, oblate	yellow, striped and splashed with dull red.
12	Canada Baldwin	Quebec	S	8	M	ovate	yellow, broken strips and splashes of red, numerous russet dots.
13	Duchess	Russia	S	5	L	round, oblate	yellow, splashed with light red in sun.
14	Fallawater	Pennsylvania	S	10	L	round, ovate	greenish yellow, shaded with a dull red and few large whitish dots.
15	Fall Queen (Haas)	Kentucky	U S	6	M	oblate, conical	yellow, striped with crimson, covered with white dots.
16	Fameuse	Canada	S	6	M	round, oblate	yellow, tinged with pale red and dark cheek, in sun.
17	Grand Sultan	Russia	U	6	L	ovate	whitish yellow, striped and splashed with red in sun.
18	Hawthornden (old)	Edinburgh, Scotland	S	6	M	round, ovate	yellow.
19	Hawthornden (new)	" "	S	6	L	round, ovate	yellow, with a crimson blush in sun.
20	Hurlbut	Connecticut	S	8	L	round, oblate	yellow, striped and splashed with red in sun, numerous
21	Horn		U	7	M	oblate	whitish yellow, shaded, and obscurely striped with light red, small light dots.
22	Highland Beauty	Wm. Roe, Newbury, N.Y.	U S	6	S	oblate, somewhat angular.	waxen white, shaded with bright red or crimson in sun, with a few grey dots.

APPLES.—*Continued.*

TESTED AT BAY OF QUINTE EXPERIMENT STATION.

Number.	Cavity.	Stem.	Basin.	Calyx.	Weight.	Fruit. Flesh. Color.	Texture.	Flavor.
1	D	¾ inch	broad	partly open		white	buttery	sub-acid.
2	D	1 "	deep, even	large, open		yellowish white	crisp	sub-acid.
3	N	½-¾ "	narrow	closed	4 oz.	yellowish	fine grained	mild, rich, sub-acid.
4	D	½ "	small	erect, partly closed		yellow	tender	rich, sub-acid.
5	D	1-1½ inches	deep	erect, partly closed		white	tender	mild, sub-acid.
6	B	¾ inch, heavy	deep, plaited	closed		yellowish white	tender	sub-acid.
7	D	½-¾ inch	narrow	small, closed		greenish white	tender	sub-acid.
8	N	¾ "	narrow	closed		yellowish white	tender	sweet.
9	B	½ "	broad	open		yellow	breaking	sub-acid.
10	N	½-1 "	shallow, slightly corrugated.	partly closed	3 oz.	white often	firm	rich, mild, sub-acid.
11	N	1	broad	open		whitish yellow	crisp	sub-acid.
12	N	½-¾ "	broad	closed		whitish yellow	crisp	mild, sub-acid.
13	D	¾ "	deep	partly closed		white	crisp	sub-acid.
14	N	½-¾ "	small	open		green white	crisp	mild, sub-acid.
15	D	½ "	large	half open		yellowish white	tender	acid.
16	D	½ inch, slender	shallow	small, half open		white	tender, juicy	sub-acid.
17	D	¾ "	wrinkled	open		white	buttery	acid.
18	D	¾ "	wide	open		white	crisp	acid.
19	B	½ "	broad	half open		white	crisp	sub-acid.
20	D	¾ "	broad, plaited	closed		white	breaking	mild-sub-acid.
21	D	1 "	shallow, corrugated	closed	3 oz.	yellowish white	tender	mild, sub-acid.
22	D	½-¾ "	deep, corrugated	closed	3½ oz.	white	fine, crisp	mild sub-acid.

APPLES.—*Continued.*

Tested at Bay of Quinte Experiment Station.

Number.	Variety.	Origin.	Tree.		Fruit.		
			Habit.	Age of bearing in years.	Size.	Form.	Color of skin.
23	Hastings		U	8	M	ovate	yellow, striped with bright red and very dark in sun.
24	Jonathan	Mr. Phillip Rich, Kingston, N.Y.	S	6	S	roundish, conical	yellow, covered by lovely red stripes, and dark red in sun. small russet dots.
25	Lord Suffield	England	S	8	M	conical, ovate	pale, greenish yellow, slightly tinged with red in sun.
26	La Rue	Ontario	U	10	L	oblong	yellow, nearly covered with red and darker in the sun.
27	Lord Burghly	England, raised in the garden of Marquis of Exeter at Burghley, near Stamford; distributed by Mr. House, nurseryman, at Peterboro', 1865	U	8	M	round, ovate, angular.	golden yellow on shaded side, and dark red, changing to deep, clear, shining crimson on side next sun, dotted with russet specks.
28	Lady	Old French variety	U	7	S	oblate	lively lemon yellow with brilliant deep red cheek.
29	Mountain Beet	Canadian	U	6	M	oblong	yellow, covered with light red and very dark red in the sun with numerous white dots.
30	Mountain Tulip	Canadian	S	7	M	conical	yellow, striped and splashed with red.
31	Margil	France	D	5	S	ovate	orange, streaked with deep red, and nearly covered on one side with russet.
32	Mother	Massachusetts	U	7	M	oblong, ovate, ribbed	yellow, covered with a rich red, a deep red in sun.
33	Northern Spy	New York State	U	14	L	roundish, conical	yellow, striped and splashed with red in sun.
34	Northfield Beauty	Leonard D Cady, Northfield, Vermont, from seed of Siberian Crab.	U	8	M	roundish, oblate	whitish, shaded with light red, striped and splashed with two shades of rich red, a few light dots.
35	Ontario	Charles Arnold, Paris, Ont., (Spy and Wagener)	U	5	L	oblate	yellow, splashed and sprinkled with red or crimson in sun, covered with a rich bloom.
36	Pomme Gris	Canadian	U S	9	M	oblate, roundish	greenish grey or cinnamon russet, some red on side next sun.
37	Rawles Janet	Caleb Rawlis' farm, Amherst Co., Va.	S	6	M	oblate	greenish yellow, shaded and striped with red.
38	Reinette Verte	France	U S	7	M	round, ovate	yellowish green, streaked and striped with red, covered with fine grey dots.
39	Vermont Sweet	Vermont	U S	7	M	round, ovate	yellowish white.

APPLES —*Concluded.*

Tested at Bay of Quinte Experiment Station.

Number.	Cavity.	Fruit. Stem.	Basin.	Calyx.	Weight.	Flesh. Color.	Texture.	Flavor.
23	D	¾-1 "	deep	closed	4 oz.	white	tender	mild, sub-acid.
24	D	¾ "	deep, broad	closed	2½ oz.	white	tender, juicy	mild, sprightly, vinous.
25	D	½ "	broad, plaited	small, closed		white	tender	sub-acid.
26	B	1 "	platted	open	5½ oz.	yellowish white	coarse	sub-acid.
27	B	½ "	angular and plaited	partly closed	3½ oz.	yellowish	very tender	pleasant, sub-acid.
28	D	½ "	round, plaited	closed	1¼ oz.	white	crisp, tender	pleasant, sub-acid.
29	D	¾-1 "	broad, wrinkled	closed	3 oz.	white with splashes of red.	tender	sub-acid.
30	D	1 "	narrow, ribbed	closed	3 oz.	white	tender	mild, sub-acid.
31	D	½ "	angular	closed		yellow	breaking	spicy, mild, sub-acid.
32	S	¾ "	small, plaited	closed		yellow	breaking	spicy, mild, sub-acid.
33	D	¾ "	deep	partly closed		yellowish white	breaking	rich, sub-acid.
34	B	½-¾ "	small, corrugated	closed	3 oz.	white	fine, tender	sprightly, sub-acid.
35	D	¾ "	deep, even	closed		white	breaking	sub-acid.
36	B	½-¾ "	shallow, narrow	partly closed	2 oz.	yellowish	crisp, very	juicy, aromatic, sprightly, sub-acid.
37	S	¾ "	shallow	partly closed	2 oz.	whitish yellow	tender, juicy	pleasant, sub-acid.
38	D	1-1¼ inches	deep, plaited	closed	4 oz.	yellowish white	tender, juicy	aromatic.
39	D	1 inch	narrow, plaited	closed	3½ oz.	white	tender, juicy	pleasant, sweet.

BAY OF QUINTE STATION. CORRECTED RECORD OF EXPERIMENTS.

APPLES.

rieties.	Origin.	When planted.	Cultivation.	Fertilizers used.	Date of pruning.	Thinning—per cent. by hand or accident.	Time of blooming.	Date of gathering.	Yield.	Grade. Class 1.	Grade. Class 2.	Grade. Class 3.	Storage. Place.	Storage. Temperature.	Average price per bbl.	Remarks.
						bu.				bu.	bu.	bu.			$ c.	
1894.																
*Albury	Albury, Ont	1888			March			Sept	1 bu	¾	¼					
*Alexander	Russian	1878			"			"	4 bu	3½	¼	¼			2 00	
Benoni	Massachusetts	1880			"			"	4½ bu	3½	½	½				
Ben Davis		1880			April.	1		Oct. 16	5 bbls	4	1		Fruit house.	28to36	3 00	1st April, 1895.
Baldwin		1874			"			" 16	3 bbls	2½	½		"	28to36	3 00	"
Duchess	Ru-sia	1880			March	1½		Aug. 18-25 / Sept. 1	3 bbls.	3					1 75	
Fallawater		1878			"	2¾		Oct	1 bu	¾	⅛	⅛	Fruit house.	28to36	2 75	"
Fameuse	Canada	1880			April.	1		" 8	5½ bbls	5	⅓	⅙			2 50	
Northern Spy		1880			"			" 9	4 bbls	3	1		Fruit house.	28to36	3 00	"
†Ontario	Chas. Arnold, Paris, Ont., Spy X Wagener.	1890			"			" 9	1 bbl	1			"	28to36	3 00	"
1895.																
Bailey Sweet	New York State	1880	Plowed and harrowed till 15th August.	Stable & ashes.	May	1	May 16	"	8 bu	5	2	1	"	28to30	2 00	One of the best sweet apples.
Blenheim Pippin	Woodstock, Oxfordshire, England.	1893	"	"	"	½	" 16	" first week	4 bu	4			"	28to30	2 50	
Cabashea		1870	In sod	None	April.	¾	" 17	" 15	3 bu	3			"	28to30	1 50	
Lord Burghley	England; raised in the garden of the Marquis of Exeter at Burghley, near Stamford, distributed in 1865 by Mr. House, nurseryman at Peterborough.	1880	"	Ashes	May		" 7	" 20	6 bu	5	1		Shipped		2 50	Dwarf tree imported.

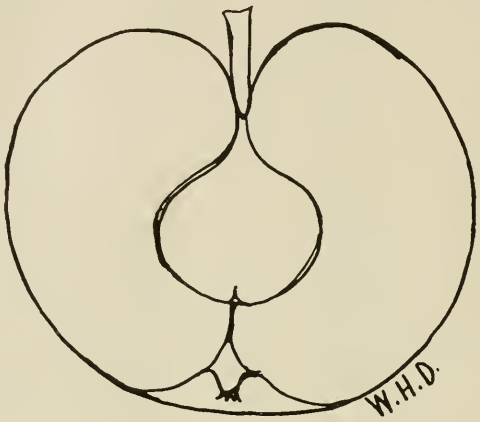
La Rue	Ontario	1880	Plowed three times, harrowed till August.	Stable..	April.	1	"	20	" 15....	4 bu...	3	½	½	"	.....	1 50	
Mountain Beet ..	Canadian.....	1880	Plowed four times and dragged till August.	" ..	" .	½	"	14	Sept	9 bu....	5	2	2	"	... .	1 25	
Mountain Tulip .	Canadian.....	1879	"	" ..	May .	½	"	14	Oct. 1....	3 bu....	½	½	½	"	.....	1 50	
Rawles' Janet ..	Caleb Rawles' farm, Amherst Co , Va.	188??	"	" ..	April.	½	"	12	"	6 bu....	3	2	1	Fruit house.	28to36	2 25	Usually too small.
Reinette Verte...	France	1880 dwarf	In sod.....	Ashes ..	June .	.....	"	16	" 20...	6 bu	5	1	....	Shipped	.....	2 25	
Vermont Sweet..	Vermont	1885 top grafted.	Plowed four times and dragged till August.	.....	May .	.....	"	14	" 10...	6 bu....	2	3	1	.....	.....	1 00	

*Dwarf trees. †Bailey Sweet, grafted to Ontario four years ago.

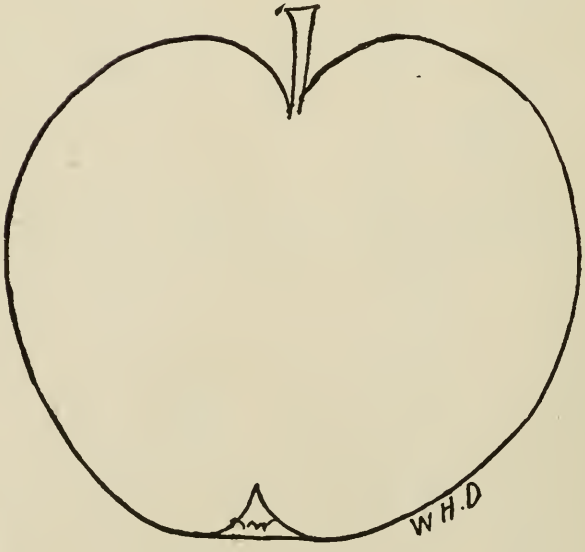
soil was a sandy loam, cultivated and fertilized with stable manure. The pruning was pyramidal. Apples were stored in cellar.

APPLES.

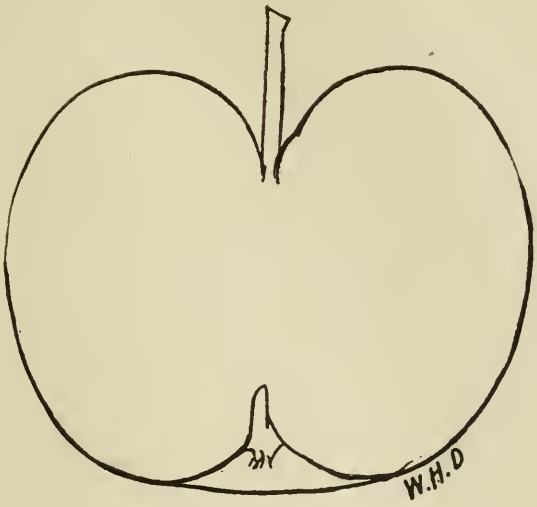
Outlines of Varieties Grown at Bay of Quinte Experiment Station.



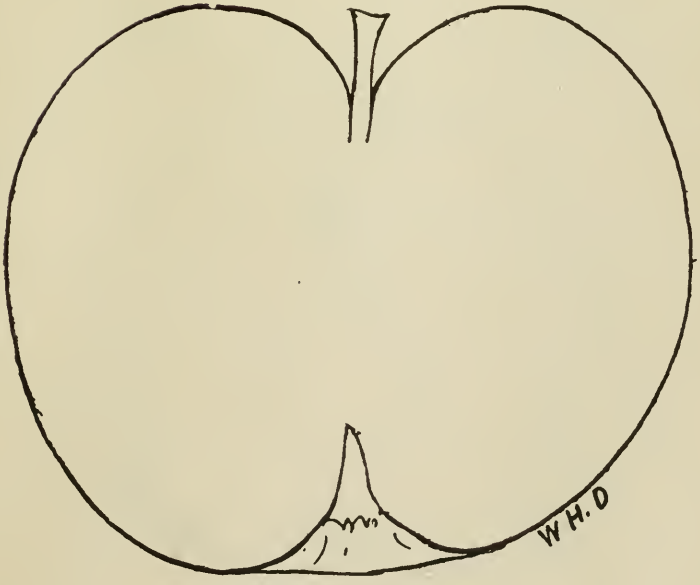
Bonum.



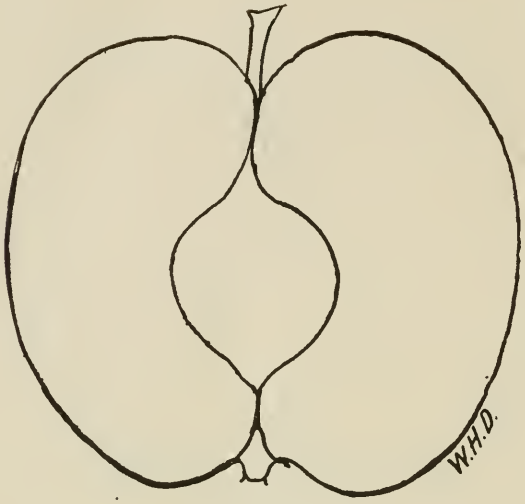
Bailey Sweet.



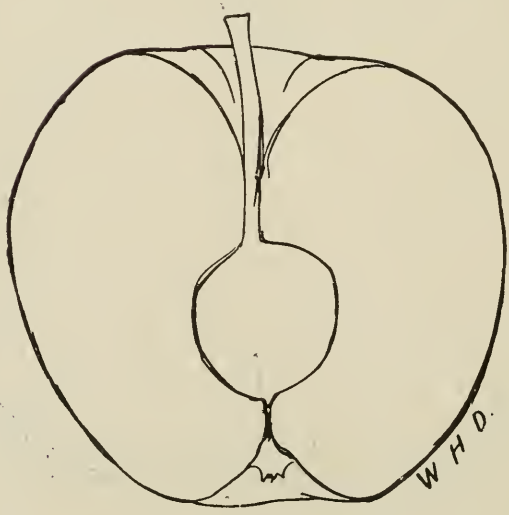
CANADA BALDWIN.



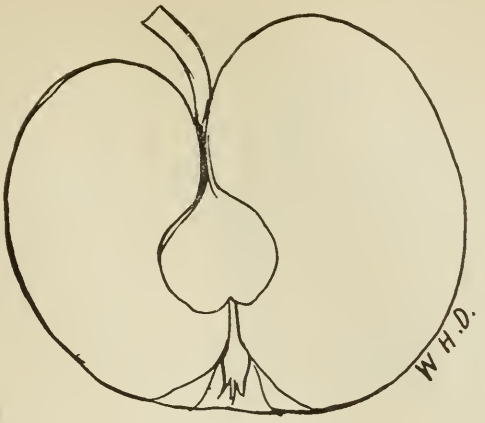
FALLAWATER.



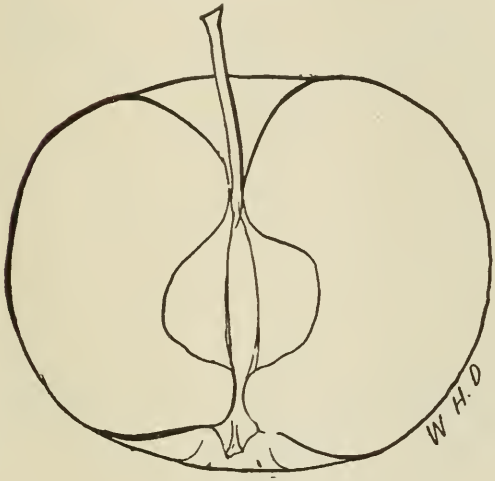
GOLDEN RUSSET.



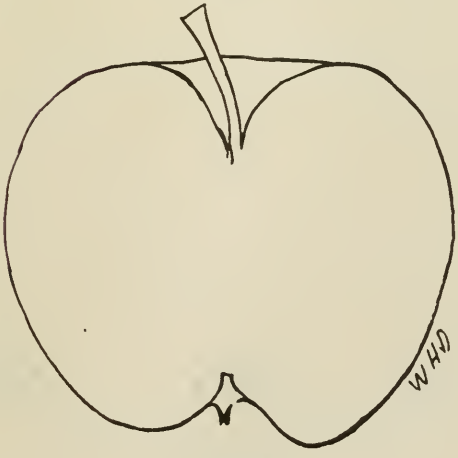
HASTINGS.



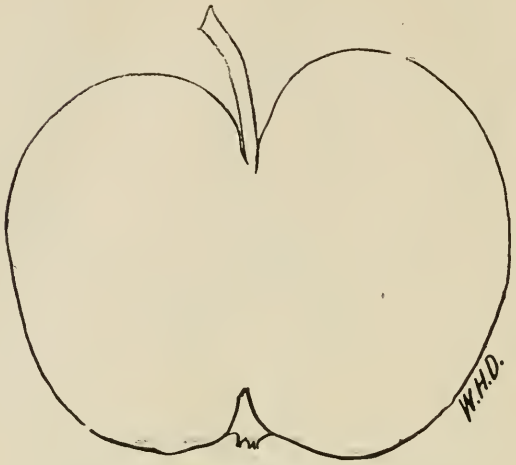
HIGHLAND BEAUTY.



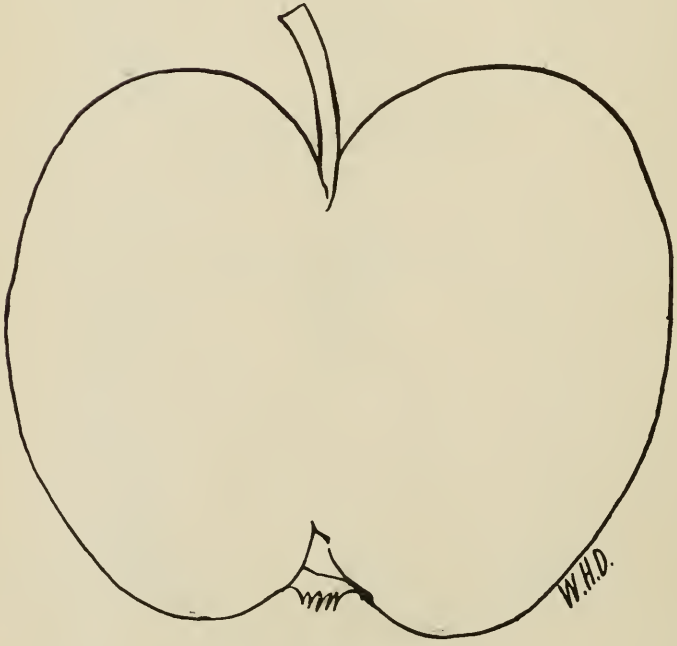
HORN.



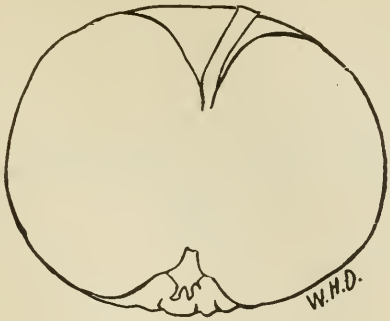
JONATHAN.



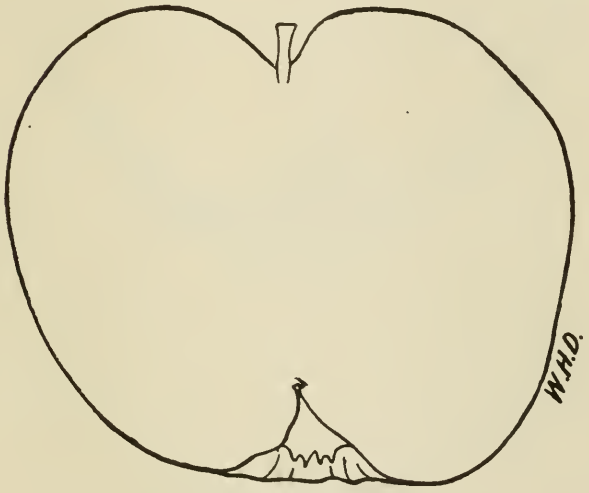
Rawle's Janet.



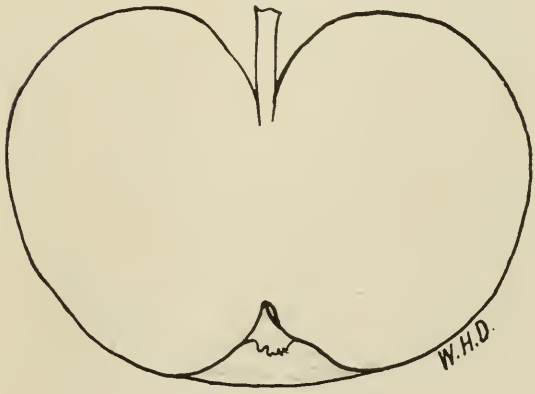
La Rue.



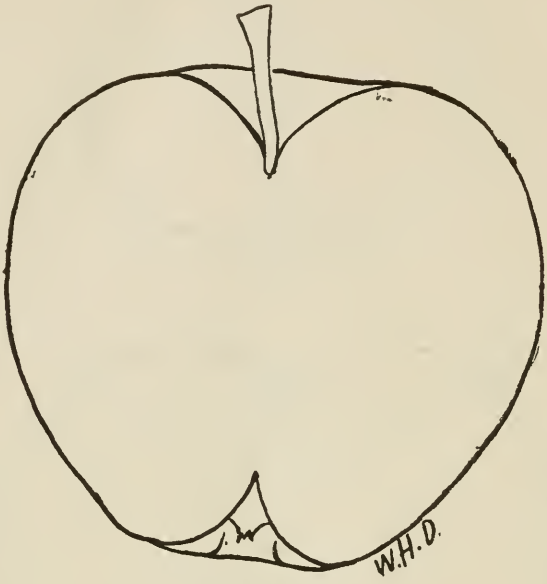
Lady.



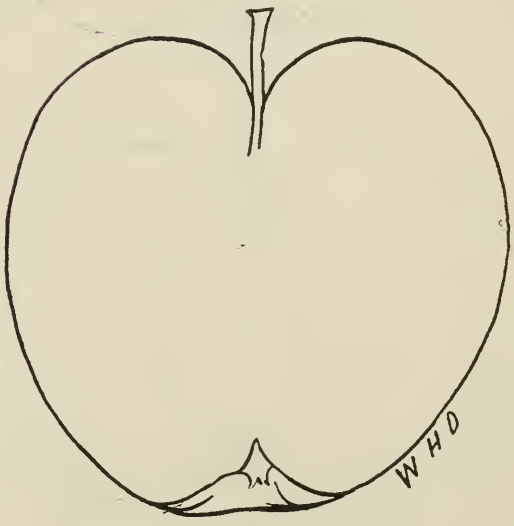
Lord Burghley.



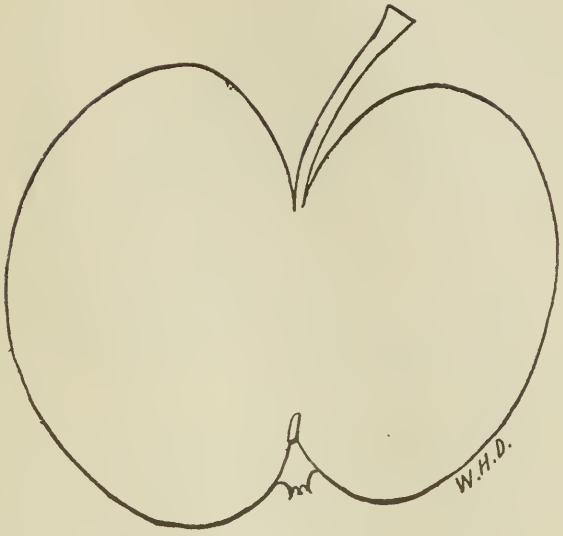
. Pomme Grise



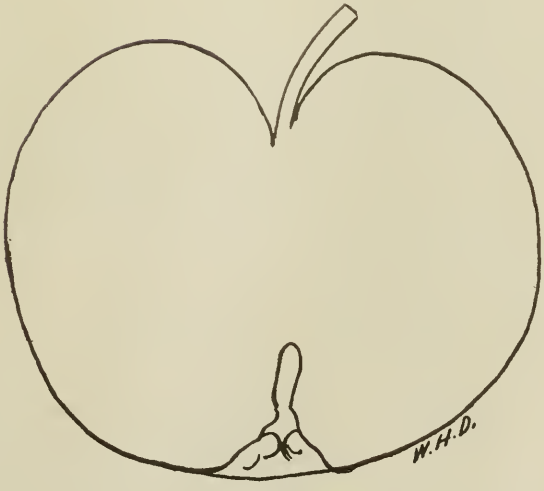
MOUNTAIN TULIP.



MOUNTAIN BEET.



Reinette Verte.



Vermont Sweet.

APPLES.

Descriptive List of Varieties Tested at the Simcoe Experiment Station: G. C. Caston, Craighurst, Experimenter.

Habit: S, Spreading; U, Upright; D, Drooping.
Form: C, Conical; R C, Roundish Conical; R Obl, Roundish Oblate; R, Roundish.
Size: S, Small, less than 1½ inches in diameter; M, Medium, 1½-3½ inches in diameter; L, Large, over 3½ inches in diameter.
Cavity: S, Shallow; N, Narrow; D, Deep; L, Large; Irreg, Irregular; W, Wide.

Number.	Varieties.	Origin.	Tree.		Fruit.		
			Habit of growth.	Age of bearing in years.	Size.	Form.	Color of skin.
1	Alexander	Russia	S	7	L	conical	greenish yellow, shaded with bright red.
2	Astracan, Red	Sweden to England	U	7	M	roundish conical	red.
3	Baxter, or La Rue	Mr. La Rue, near Brockville.	U	8	L	R C	red.
4	Ben Davis	Missouri	U	7	M	C	yellowish, with two shades of red.
5	Cayuga Red Streak	Cayuga, N.Y., from Conn		8	L	R obl C	red streaked.
6	Colvert		S	8	M L	C obl	greenish-yellow, splashed with red.
7	Duchess	Russia	S	3	M	R obl	yellow, streaked with red.
8	Fameuse	Canada	S	6	M	R obl	red.
9	Gideon	Russia	U	5	L	C	white, with red cheek.
10	Grime's Golden	Thos. Grimes, Virginia	U	7	M	C	red.
11	Haas		S	8	M	flat	white, with red cheek.
12	Hurlbut	Gen. Hurlbut, Conn	S	9	M	R obl	yellow when ripe.
13	King	New Jersey	S	10	L	R	red.
14	Maiden's Blush	New Jersey	S	8	L	flat	lemon yellow, with bright crimson cheek.
15	Mann	New York State	U	7	M	R obl	green, turning yellow, with light and gray dots.
16	Northern Spy	Near Rochester, N.Y	U	13	M L	R obl C	red streaked.
17	Pewaukee	Pewaukee, Wis	U	6	M	C	red streaked.
18	R. I. Greening		S	10	M	R obl	green.
19	Ribston Pippin	Yorkshire, Eng		7	M	R C	brownish russet, tinged with red.
20	St. Lawrence	Uncertain	U S	8	M L	obl C	streaked with red.
21	Talman Sweet	Rhode Island	U S	8	M	R	whitish yellow, sometimes with a blush line from stem to calyx.
22	Tetovsky	Russia	U	4	M	obl C	yellow, striped with red, slight bloom.
23	Wealthy	Peter Gideon, St. Paul, Minn.	S	3-4	M	R obl	whitish-yellow, shaded with deep crimson.
24	Wagener	Pen Yan, N.Y	S	8	M	R obl	yellow, nearly covered with crimson.
25	Yellow Transparent	Russia	U	4-5	L		yell w.

APPLES.

Descriptive List of Varieties Tested at the Simcoe Experiment Station, etc.—*Concluded.*

Number.	Fruit.					
				Flesh.		
	Cavity.	Basin.	Calyx.	Color.	Texture.	Flavor.
1	D	deep	large	yellowish, white	a little soft, juicy	pleasant.
2		slight	partly closed	white	crisp, moderately juicy	spicy, acid.
3				white	firm	slightly acid.
4	N D	wide, abrupt	partly open	white	firm	poor.
5	W D	deep	small	whitish	coarse	sub-acid, poor.
6				greenish-white	firm	brisk, sub-acid.
7	S	wide, even	large, nearly closed	white	firm, juicy	pleasant, acid when ripe.
8	N, fine shaped	shallow, narrow	small	very white, sometimes streaked with red	tender, juicy	pleasant, slight perfume.
9				white	firm	pleasant.
10				yellow	crisp, tender, juicy	rich, sprightly, sub-acid, aromatic.
11				white, tinged with red	firm	poor.
12		shallow	closed	white	crisp, tender, juicy	pleasant, mild, sub-acid.
13		medium, slightly corrugated	small, closed	yellowish	juicy, tender	agreeable, rich, vinous, aromatic.
14	L irreg		closed	white	tender	sprightly, pleasant, sub-acid.
15	D	large, slightly corrugated	closed	yellowish	firm	pleasant when ripe, sub-acid.
16		narrow, furrowed	small, closed	white	fine-grained, tender	sprightly, sub-acid, very finest.
17	W D		small, closed	white		sub-acid, pleasant when ripe.
18				yellow	fine-grained, tendor, crisp, juicy	pleasant aroma, rich.
19	W	angular	small, closed	white	firm	one of the best, fine flavor.
20	L	small, deep	firmly closed	white	crisp, juicy, tender	pleasant, rich.
21	W S	small, depressed		white	firm, fine-grained	sweet and rich.
22				white	juicy, soft	pleasant, sub-acid.
23		deep, abrupt, uneven	partly closed	white, stained with red	fine-grained, tender, juicy	pleasant, slightly acid, crisp.
24	L B irreg	abrupt, corrugated	small, closed	yellowish	tender, juicy, brisk	excellent.
25				white	firm	fair.

NOTES ON VARIETIES OF APPLES IN 1895.

I have planted this year for experimental purposes twenty-eight varieties of apples, including ten varieties of crabs. The apples were of the following varieties :—Gano, Gideon, Sweet Bough, Salome, Sherwood's Favorite, Shackleford, Wolf River, Tetofsky, Red Canada, Primate, Hastings, Peerless. The latter from Minnesota, said to be a seedling of the Duchess. I received from Iowa, Sweet Longfield, Regel, Good Peasant, Vargul, Lubsk Queen and Anisim. These were duplicates, as I had these varieties already. Of the twenty-eight varieties of apples tried ten were crabs of the following varieties :—Hyslop, Martha, Minnesota Winter, Orion, Picta Stricta, Paul's Imperial, Quaker Beauty, Telfer Sweet, Van Wyck, Whitney. Of apple scions for grafting I received the following :—Gravenstein, Bethel, Parsons Sweet, Utters Red, Magog Red Streak, Nodhead, Newton Pippin, Coles' Orange Pippin, Jonathan, Starr, Banks' Red Gravenstein, also two seedling apples from Muskoka, viz., McMillan and Sally Brown.

Of the varieties of apples under test I have little to add to the report of last year, as none of the new varieties have fruited, except the Yellow Transparent. One tree of this variety one year planted bore three apples. As it was described in the report of last year it will be unnecessary to repeat it. But I think it well just here to give a few notes on a few varieties of HARDY APPLES grown in this section that seem to do well and that are valuable for home and foreign market.

The Wealthy.—This apple cannot be classed as a winter apple even in this northern section. It is undoubtedly a fall apple, and requires to be picked, packed, and marketed in September. But to anyone who can secure a market for it at home or abroad at that time of year there is no apple that I know of that will give as good a profit as the Wealthy. It seems to find a congenial climate here, and attains to great perfection all through this section of country. It is the fall apple *par excellence* of Simcoe Its good points are fine quality, bright handsome color (their appearance either in baskets or barrels is simply superb), early bearing, regular bearing, and their ability to bear large crops of a uniform size and quality. Its faults are chiefly two. First, the form of growth of the tree renders it liable to split when loaded ; and second, the premature dropping of the fruit. The first may be remedied by the proper training of the tree while young, and the second by picking the fruit just as soon as it attains full size and color.

The Pewaukee.—This apple does well and will keep nearly as long as the Spy, but has a very bad fault. The fruit is liable to drop during windy weather before attaining full size or maturity.

The Mann.—This is quite a popular variety here, seems hardy enough for this section, bears well, and is considered by many equal if not superior to the R. I. Greening.

Bottle Greening.—Popular in the Collingwood district, and does well all through this county. One of the most valuable of the green apples for export.

Fallawater.—This is likely to prove one of the most valuable of the winter varieties for this section. It does remarkably well all through the county and attains great size and beauty wherever it receives good care and cultivation. It is going to be one of the most valuable varieties for export. It has been quoted at 18s. 6d. per barrel in Liverpool this fall. The tree is healthy and vigorous and seems quite hardy here. It is thus described by Downing : Fruit very large, globular, inclining to conic ; skin, yellowish green, shaded with dull red and sprinkled with large grey dots ; stalk very short, inserted in a deep cavity ; calyx small and closed, set in a slightly plaited basin ; flesh greenish white, juicy, crisp, rather tender, pleasant subacid flavor, good November to February. In this section it keeps well till April. Downing also describes the tree as a strong grower and very productive.

I might name the following as a valuable selection for orchard planting for this section:—Summer, Duchess ; fall, Wealthy, Alexander ; winter, Fallawater, Mann, Bottle Greening, Spy, King, Baldwin, the last three to be top grafted on Tolman Sweets or other

hardy stock. Of the older varieties that are still in demand for dessert apples I might mention Fameuse and St. Lawrence, and in their season these are hardly excelled by any others for that purpose.

Spraying.

I have made during the spring and summer a thorough test of the effects of spraying with Bordeaux mixture for the apple scab, and with Paris green for the codling moth. The first spraying on the bare trees was done with a mixture of two pounds copper sulphate to forty gallons water. After the blossoms fell the Bordeaux mixture was used, four pounds copper sulphate to forty gallons water, and four ounces Paris green to forty gallons. The lime was put in by the cyanide of potassium test, and to make sure a third more lime was added after the test showed enough. The mixture was kept thoroughly agitated and put on with a Vermorel or a McGowan nozzle, using each alternately. The spraying was done in a most thorough manner. The leaves were covered with the mixture most of the summer, there being little or no rain during the spraying season or several weeks after the last spraying. One tree in a row of each variety was left unsprayed for purposes of comparison.

Results.

The apples in my orchard being almost an entire failure owing to the May frost, I cannot give any tabulated statements as to per cent. of fruit and second quality. The fruit, what little there was, was certainly cleaner and slightly larger on the sprayed trees. This was more apparent on the Spy, La Rue, Wealthy and Astrachan A difference was also noticeable on the foliage, and late in the fall the leaves were all off the unsprayed trees while yet green and bright on the sprayed ones. One thing occurred however that showed that some varieties of apple trees are more liable to injury from repeated application of the Bordeaux mixture than others. The Golden Russet and La Rue lost about three-fourths of their foliage about midsummer. These trees presented a pitiful sight about this time with most of their leaves yellow and falling off, while other varieties alongside in the same rows were not affected at all. However, it did not seem to affect the fruit at all, and after the discolored leaves had fallen the trees seemed to regain their normal color and appearance. I attribute this effect to the long spell of dry weather and the leaves being constantly covered with Bordeaux their pores became clogged and smothered. But why some varieties should be affected in this way while others under precisely the same treatment should not show any damage, I cannot at present account for.

Conclusions.

While not wishing to say anything to underrate the value of spraying, especially for the prevention of the damage from codling moth and other insect enemies, yet I believe that as regards the apple scab, an orchard planted on rolling ground, with the trees well pruned and planted far apart to insure a free circulation of air and plenty of sunshine, will have much cleaner fruit than an orchard on low, flat ground, with the trees too close together and pruning neglected till the trees are a mass of brush, keeping out the sunshine and preventing a free circulation of air, no matter how thoroughly and well the latter may be sprayed.

That some varieties of apples are much more susceptible to injury from Bordeaux mixture than others, and finally that more than one season's experiments are required before definite results and conclusions can be reached as the effects of the year's work, may be more apparent next year than this.

G. E. Caston,
Experimenter.

PEARS.

Descriptive List of Varieties Tested at Bay of Quinte Experiment Station: W. H. Dempsey Experimenter.

Habit: U, Upright. S, Spreading. D, Drooping.

Form: Obt., Obtuse. Obl., Oblong. Obo., Obovate. Py., Pyriform. Ob., Oblate.

Cavity: S, Shallow. N, Narrow. D, Deep. B, Broad.

Size; S, Small. M, Medium. L, Large.

Number.	Varieties.	Origin.	Tree.		Fruit.		
			Habit of growth.	Age of bearing in years.	Size.	Form.	Color of skin.
1	Annanas d' Ete	Holland	U	10	M	obtuse pyriform	yellowish green with a brownish tinge on side next sun.
2	Bartlett	England	U	6	M	oblong, obtuse pyri.	clear yellow, sometimes a little bluish in sun.
3	Belle Lurcative	Belgium	U	8	M	conic obovate	lemon yellow, sometimes green.
4	Beurre Clairgeau	Nantes, Mr. Clairgeau	U	10	M	obovate pyriform	yellow, or yellowish brown.
5	Beurre d'Anjou	France	S	10	M	obtuse pyriform	greenish yellow, with a brown cheek next the sun, covered with small russet dots.
6	Beurre Gris d' Hiver	France	U	10	M	obovate	greenish russet.
7	Beurre Hardy		U	6	M	obovate, obtuse py.	yellow, covered with thin brown russet.
8	Buffum	Rhode Island	U	8	M	oblong obovate	yellow, with a brown cheek.
9	Boussock	Belgium	U S	8	M	obovate	lemon yellow, sprinkled with russet dots.
10	Clapp's Favorite	Thaddeus Clapp, Dorchester, Mass	U S	6	M	pyriform	yellow, shaded with red.
11	General Todleben	Belgium, M. Fontaine	U S	10	L	oblong, obtuse py.	yellow, with russet dots, or patches of russet or brown.
12	Josephine de Malines	Major Esperen, of Malines, France.	S D	8	M	roundish oblate	green, turning yellow, with a little flush of red next the sun, large russet dots.
13	Lawrence	Flushing, Long Island	U	8	M	obovate, obtuse, py.	lemon yellow, thickly dotted with minute brown dots.
14	Louise Bonne	France	U	6	M	oblong, ovate, py.	pale green, overspread with brownish red in the sun, numerous grey dots.
15	Mount Vernon	Samuel Walker, Roxbury, Mass	U	5	M	roundish, obtuse py.	yellow, nearly covered with light russet, brownish red in sun.
16	Onondaga (Swan's Orange)	Farmington, Conn	U S	6	M	obovate, obtusely py	yellow, thickly covered with russet dots.
17	Sheldon	Norman Sheldon, Huron, Wayne Co., N.Y	U	.....	M	roundish obtuse, obo.	greenish yellow, nearly covered with light russet grey dots, brownish in the sun.

PEARS.

Descriptive List of Varieties Tested at Bay of Quinte Experiment Station, Etc.—*Concluded.*

Number.	Fruit.						
					Flesh.		
	Cavity.	Stem. length.	Basin.	Calyx.	Color.	Texture.	Flavor.
1	S	1½ inch	shallow	partly open	white	buttery	sweet, stringent.
2	S	1 inch, stout	very shallow	open	white	buttery, melting	mushy, aroma, sub.-acid.
3	S	1¼ inch	shallow	open	white	tender, very juicy	sweet.
4	S	½ inch to 1 inch	shallow	open	white	granular	poor.
5	S	½ inch to ¾ inch	shallow	open	white	buttery, melting	sub-acid.
6	S	½ inch thick	small	large, open	white	granular	sub-acid.
7	S	⅝ inch to 1 inch	small, uneven	open	white	buttery, melting	sub-acid.
8	S	¾ inch	small	half open	greenish white	buttery	sweet.
9	S	¾ inch	shallow, even	open	white	melting, juicy	sub-acid.
10	S	½ inch thick	small, wrinkled	partly closed	white	juicy, melting	sub-acid.
11	S	2 inches	wide, furrowed	open	rosy tinge	melting, juicy, slightly granular.	mild, sub-acid.
12	N	1 inch, stout	shallow	open	rosy tinge	melting, juicy	sugary, with a rich aroma.
13	N	1 inch, stout	broad	open	whitish	juicy, melting	sweet, aromatic.
14	S	1 inch	uneven	open	greenish white	juicy, melting	rich aromatic.
15	S	1 inch	shallow	closed	yellowish	juicy, melting	vinous and slightly aromatic.
16	S	1 inch to ½	uneven	closed	white	buttery, melting	vinous.
17		1 inch	broad	open	white	juicy, melting	sweet, vinous, rich aromatic.

PLUMS.

DESCRIPTIVE LIST OF VARIETIES TESTED AT THE GEORGIAN BAY STATION: JOHN G. MITCHELL, CLARKSBURG, EXPERIMENTER.

Origin: Originator, place, date, parentage.
Foliage: Subject to diseases, size, glossiness, quantity.
Habit: S, spreading; U, upright.

Size: M, medium; L, large; S. small.
Cavity: S, shallow; N, narrow; D, deep; B, broad.
Suture: L, large; D, distinct; Ob., obscure.

Number.	Variety.	Origin.	Tree.						Fruit.		
			Habit.	Foliage.	Vigor, Scale 1-10.	Hardiness. Scale 1-10.	Productiveness. Scale 1-10.	Age of bearing, in years.	Size.	Form.	Skin. Color.
1	Lombard	Mr. Lombard, Springfield, Mass.	U	medium, crimped, healthy	10	10	10	3-4	M	roundish oval	violet red
2	Coe's Golden Drop	Mr. Coe, near London, Eng.	S	large, glossy, plentiful	4	8	8	4	L	oval	light yellow
3	German Prune	German	S	medium, glossy, healthy	6	7	7	5	M	long, oval	purple
4	Pond Seedling	English	U	healthy	10	10	8	4	L	oval	red
5	Glass Seedling	Mr. Glass, near Guelph, Ont.	U	glossy, curled, plentiful	10	10	9	9	L	oblong, roundish	deep purp
6	Reine Claude de Bavay	Major Esperene, Vilvorde	U	large, glossy, abundant	8	7	8	4	M	roundish, slightly depressed	greenish yellow
7	Bradshaw		U	healthy	7	8	9	4	L	oval, obovate	reddish purple
8	General Hand	uncertain	U S	healthy	10	9	6	6	L	roundish oval	golden yellow
9	Imperial Gage	Princess Nursery, Flushing, N.Y.	U	healthy	10	8	9	6	M to L	oval	yellow, dull, green stripes
10	Smith's Orleans	Mr. Smith, Gowanus, L. Island	U	crimped, very healthy	10	10	9	5	L	oval	reddish purple
11	Washington	Mr. Delancy, New York city.	S	large, broad, glossy	9	7	8	4-5	L	round, oval	dull yellow
12	Quackenbos	S. C Grott, Albany, N.Y.	U	glossy, curled, plentiful	10	10	9	6	L	oblong, roundish	deep purple

PLUMS.—*Concluded.*

DESCRIPTIVE LIST OF VARIETIES TESTED AT THE GEORGIAN BAY STATION: JOHN G. MITCHELL, CLARKSBURG, EXPERIMENTER.

Number.	Fruit.									Quality. Scale 1 10		Value. Scale 1-10		Remarks.
	Skin.		Stem.	Suture.	Seeds or stone.	Flesh.			Season. (Months of use, as Dec.-Mar.)	Dessert.	Cooking.	Home market.	Foreign market.	
	Bloom.	Cavity.				Color.	Texture.	Flavor.						
1	thin	N	slender...	Ob	cling	deep yellow	juicy.....	pleasant, not rich	Sep	8	9	8	8	Hardiest, most curculio proof, profitable variety I know of.
2	.....	none	long, stiff, set on end of fruit.	D	cling	yellow	firm	rich, sweet	Sep-Oct..	7	10	10	10	Slow grower.
3	thick, blue	S	slender.....	D	free	green	firm	sweet	Sep-Oct..	....	9	8	10	
4	thin, whitish ..	N S	long, slender ..	D	cling	yellow	coarse, juicy ..	not rich	Sep-Oct..	4	7	7	10	Sells well on account of its fine appearance.
5	blue	D	long, slender ..	Ob	cling	greenish yellow..	coarse	sweet, sub-acid	Sep . ..	4	8	7	10	Too late coming into bearing. Should be planted with other varieties.
6	thin	S	short, stout ...	D	free	yellow	juicy.....	sugary, rich ..	Sep-Oct..	10	10	10	10	
7	light	S	stout.....	L	semi-cling..	yellowish...	coarse, juicy ..	pleasant	Aug-Sep.	8	9	10	10	
8	.....	S	long	Ob	free	pale yellow.....	coarse	sweet	Sep	7	8	10	10	Uncertain cropper.
9	white	S	long, stout	D	free	greenish	juicy, melting..	rich	Aug-Sep.	10	10	10	10	Does well here.
10	deep blue.....	D N	small, slender..	D	cling	deep yellow	firm, juicy	rich	Aug-Sep.	6	9	9	10	
11	....	S B	short.....	Ob	free	yellow	firm	very sweet	Aug-Sep.	10	10	10	10	
12	blue	D	long, slender ..	Ob	cling	greenish yellow..	coarse	sweet, sub-acid	Sep	4	8	7	10	Bears well after 8 years old.

NOTES ON VARIETIES.

I received this spring for testing at the Georgian Bay Experiment Station, at Clarksburg, thirty-six varieties of plums, thirteen of pears, eight of peaches, three of cherries, and a few raspberry plants. Of plums that I have already tested I will only refer to a few of the most desirable.

Plums.

Lombard, the fastest grower, hardiest, most curculio proof, and profitable all-round plum I know of. Ninety per cent. of all the plums in the Georgian Bay district this season are Lombards. Should be well fertilized and cultivated.

Glass Seedling, a strong grower; very hardy; attains a large size; bears well after eight or ten years old if planted with other varieties. I have known as much as twenty-four baskets to be taken off a single tree in a season.

Coe's Golden Drop, a slow grower, with short stout shoots and glossy leaves; great bearer; a little liable to rot; but not badly here.

Reine Claude d'Bavay, a fine late plum, thought to be a little tender by some growers here, but I do not find it so; quality best.

Pond's Seedling, a strong, upright bearer like a poplar; bears young; fruit rather coarse, but sells well; should be headed back.

Quackenbos, much like Glass Seedling; bears younger; thought to be the parent grows large, lives long. Profitable for market.

Bradshaw, a fine large plum with reddish purple color; excellent quality; vigorous; productive; annual bearer.

Washington, fruit large, clean, yellow, marked with red; quality best; vigorous, productive every second year; does well here.

Smith's Orleans, large, reddish purple; grows well; bears abundantly; does well here.

Apples.

It was once asked the question, "What varieties of apples can be grown in your district?" Well, I would like to know what varieties cannot be grown here. There are upwards of 225 varieties in the Beaver Valley and along the shore of the Georgian Bay. If the 200 were converted into the twenty-five best, the country would be a good deal better off. The following are a few of the best and most profitable varieties:—

Northern Spy, large, roundish conical; striped and covered with crimson on sunny side; overspread with a thin bloom, flesh, juicy, rich, aromatic, best quality; does remarkably well here.

Baldwin, too well known to need description; bears immense crop of fine, clean fruit.

Golden Russet, thriftly, upright grower; bears well.

American Russet, requires rich soil.

King of Tompkins Co., a fine apple; rather shy bearer, but bears well if top-grafted on Tolman Sweet or Russet. In fact, the finest Kings I ever saw were grown on a graft on Swayzie Pomme Grise.

Ben Davis, a rapid grower; early and annual bearer of heavy crops; sells well.

Gravenstein, the best of the fall varieties: fine grower; productive; quality best.

St. Lawrence, very free grower; healthy foliage; productive.

Fameuse, a good grower; bears well, but has spotted badly of late years. Grew a fine, clean crop this year, where properly treated with Bordeaux.

R. I. Greening, fine, strong grower ; spreading top ; bears young ; best quality.

Pewaukee, strong grower ; bears young ; fine, clean fruit with handsome bloom ; but drops badly on either clay or sandy soil.

I will just mention a few more varieties that will do well. Alexander, Colvert, Twenty Ounce, Seek-no-further, Ontario, Rox Russet, Blenheim Orange, Ribston Pippin, etc., etc., all grow to perfection here.

Three Years' Experience in Spraying for Curculio.

1893. Sprayed plum trees as soon as the fruit set, with—water forty gallons ; Paris green 3 oz. Left six trees unsprayed for test. Result—the sprayed trees had a good crop ; the six unsprayed trees had but one plum and that one stung.

1894. Sprayed with same mixture and at same time, just when the fruit had formed Left five trees unsprayed for test ; result—the sprayed trees were loaded to the ground. The five trees not treated did not carry a single plum, although equally well set with fruit.

1895. Sprayed again with water and Paris green as soon as fruit set. Left no trees unsprayed this time. Sprayed again in seven days with Bordeaux and Paris green. Result—all trees bore heavily according to setting of fruit.

Experience in Spraying Apples.

1895. This year I sprayed part of my apple orchard before the buds had burst, and twice after. The trees treated in this manner bore beautiful clean fruit, with very few culls. The remainder of apple orchard which was not treated till the fruit set did not seem to be much benefited by the spraying. There is no doubt in my mind, but the early spraying is the most effective for apples and I shall continue it.

John G. Mitchell,
Experimenter.

PEACHES.

Report of South-Western Station, 1895. W. W. Hilborn, Leamington, Experimenter.

The fall of 1894 was very dry and peach trees ripened up their wood and fruit buds perfectly before cold weather set in. They therefore entered into winter quarters in perfect condition so far as the condition of the wood and fruit buds were concerned. The soil, however, was so dry when cold weather came that the frost penetrated very deep and quite a number of trees were root killed from this cause. Especially was this true in soils naturally very dry. The winter was the most severe known in this vicinity for many years. The fruit buds, nevertheless, came through in splendid condition, and a large crop of fine fruit was gathered this season. The late spring frosts so disastrous in nearly every other, perhaps I may say, every other portion of Ontario, did but little injury to the fruit crop in this locality. The early sorts of peaches ripened fully a week or more earlier this season than last. Late varieties were later in ripening than usual owing to the cool weather during their period of ripening. Salway and some of the other latest kinds were injured by the first hard frost which occurred October 20th.

It is not often that we get enough frost in this locality to injure the peach before November 1st.

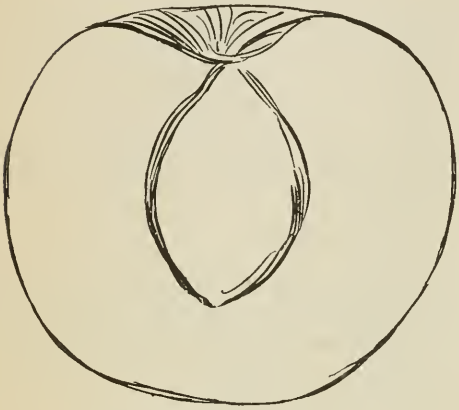
All of the earliest varieties have white flesh, and more or less cling to the pit. None of the early sorts are firm enough in flesh to stand shipping as well as the later and yellow fleshed kinds.

In selecting varieties for market it is best to choose the greatest number of such kinds as will produce large fruit of fine appearance, yellow flesh, and ripen mid-season. At this time the demand for peaches is very much the greatest. It is well, however, to plant such varieties as will give a constant succession from the first to the last of the season. In making up the list of kinds described below I have given them in the order of ripening this season.

Notes on Varieties of Peaches.

(In order of ripening.)

Alexander. This is the earliest sort grown in this locality. Ready for market this season July 23rd. Tree moderately strong grower—hardy and very productive. Fruit medium to large, nearly round, skin greenish white, nearly covered with deep, rich red, purplish in the sun. Flesh whitish with a tinge of green, half melting, juicy, sweet, partial cling.



Alexander, July 23, '9

Early Canada, Amsden's June and Waterloo are practically the same as Alexander.

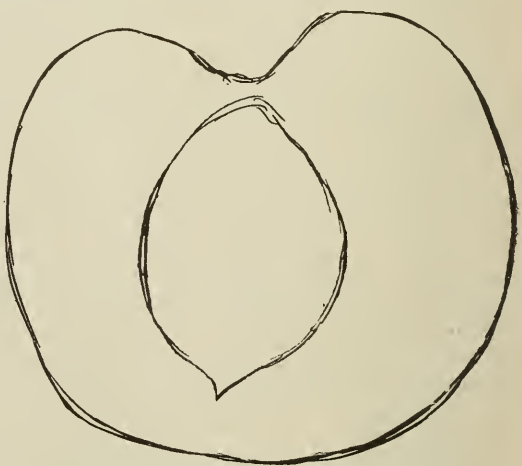
Early Rivers. Tree a good grower, hardy and very productive. Fruit round, medium to large, straw color with a delicate pink cheek, flesh melting and of fine quality. Partial cling, although not as much as Alexander, Not firm enough to carry well to a distant market. Ripe August 8th.

Hale's Early. Tree a good grower, hardy and very productive. Fruit medium size, nearly round. Skin greenish, mostly covered and mottled with red when ripe. Flesh white, melting, juicy, rich, sweet, nearly freestone. Ripe August 13th.

The fruit has been quite free from rot here, to which, it is subject in most localities.

Lewis' Seedling. Tree vigorous, very hardy and productive. Fruit medium to large, nearly round, color of Alexander except that the skin and flesh is a little lighter in color, good quality. Not fully tested here. Ripens August 15th.

Boyle's Yellow. Tree good grower, hardy and productive. Fruit above medium size. Skin very bright yellow, with a fine bright red cheek. Flesh yellow, melting, sweet, rich and of very fine quality. Ripe August 18th. This was the first freestone to ripen here. Its good quality, early ripening, fine appearance and productiveness, will, I believe, make it very popular when better known, both for home use and market.



Lewis' Seedling, 2⅝ in., August 15th, '95.

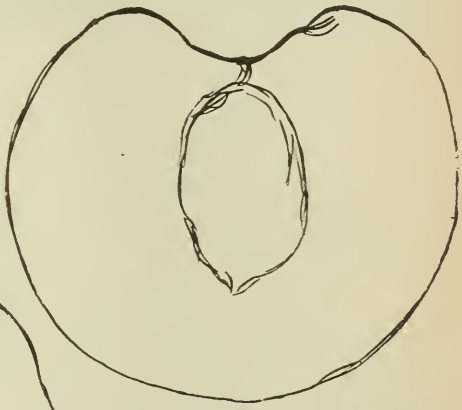
Mountain Rose. Tree vigorous, healthy and productive. Fruit medium or above. Skin whitish, nearly covered with red, flesh white, very good, freestone. Ripe August 20th.

Barnards Early. Tree a moderately strong grower, very hardy and productive. Fruit round, medium to large; (when the trees are not overloaded); skin yellow, nearly or quite covered with dark red; flesh rich and sweet, of good quality; red at the stone; freestone; one of the most reliable; ripe August 25th.

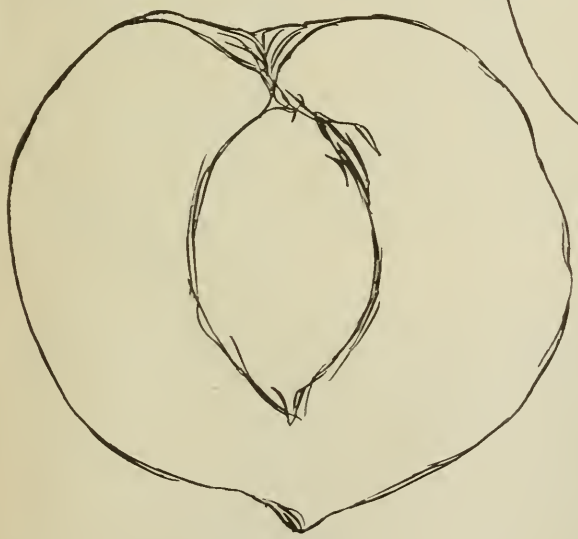
Early Crawford. Tree a free grower and productive, although the fruit buds are not quite as hardy as many other kinds. Fruit, very large; oblong; skin, yellow, with a fine red cheek; flesh, yellow, rich and of fine quality; freestone; ripe last of August.

Champion. This is a new variety that has been boomed quite extensively for the last two or three years. It was claimed for it that it was the earliest freestone known. It has been fruited this season in a number of orchards in this locality and all prove to be nearly or quite as much of a clingstone as Alexander. Tree a very free, strong grower; fruit medium to large; flesh, whittish green; quite soft; of good quality; clingstone; ripens about with Early Crawford. Present indications would show that it has no place in the commercial orchard. It is just possible that it will be valuable for the amateur, in localities not well adapted to peach culture on account of its hardiness.

Oldmixon. Tree a vigorous grower, not quite hardy in fruit bud it therefore yields well only in favorable seasons. Fruit, large roundish; skin, pale yellowish white; marbled with red; cheek, a deep red; flesh, white; red at the stone; of the very best quality; not firm enough for shipping to a distant market; freestone; ripe September 1st.



Boyle's Yellow, 2⅞ ins., August 18th, 1895.



Garfield, 3 in., August 27th

Fitzgerald. Tree a good grower, hardy, and gives promise of productiveness, but not sufficiently tested to speak positively in this respect. Fruit resembles Early Crawford to some extent; of better quality; ripens a little later; one of the most promising new sorts for market and home use.

Yellow Rareripe. Tree a free grower, hardy and productive. Fruit, very large; roundish; skin, yellow, nearly covered with dark red; flesh, yellow and of the best quality; not quite as firm as Early Crawford; ripe September 5th.

Elberta. Tree a strong, free grower; foliage very large, dark glossy green; fruit large to very large, roundish; skin yellow, with red cheek, sometimes nearly covered with red; flesh yellow, firm, rich and sweet; freestone. Promises to be one of the most valuable new peaches introduced. Its fine appearance, large size, firmness and good quality will place it in the front rank as a market peach should the tree prove as productive as it grows old as it is while young.

Garfield. Tree strong and vigorous; fruit of the early Crawford type. I have fruited it only on young trees; on these it produces larger fruit than does the early

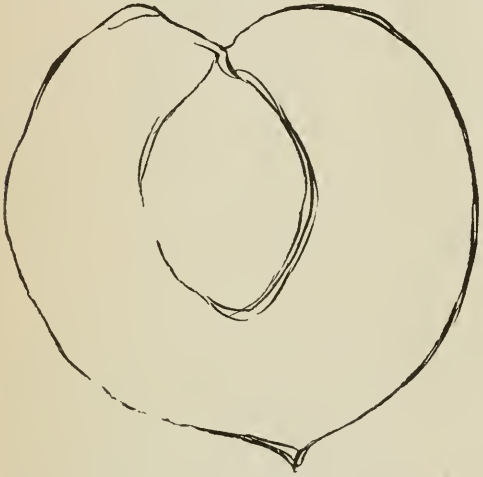
Crawford on trees of same age, equally as good in quality and appearance and in every other way as that old favorite, the early Crawford. Cannot say as to its productiveness. Ripens a little later.

Wheatland. Tree, a good grower of the Crawford type; unproductive with me, hence of no value up to present date.

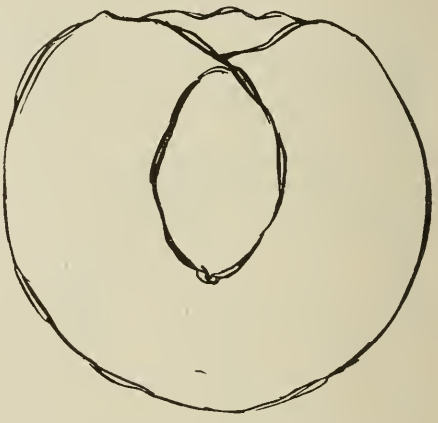
Tyhurst. Tree of small willowy growth; very hardy in wood and fruit-buds, it therefore yields well annually. Fruit medium, round; skin, light yellow, sometimes carmine in the sun. Flesh, yellow, sweet, and of the best quality, freestone. Ripens middle of September.

Wager. Tree, moderate grower, healthy, hardy and productive. Fruit, medium in size, oblong, oval, varying in form, one side often enlarged. Skin, quite downy, of a light golden yellow when fully ripe; flesh, bright yellow, rather firm. Medium quality, freestone. Fruit drops quite bodily when about ready to gather. Ripens middle of September.

Engol's Mammoth. Tree, a vigorous grower, quite hardy and productive; fruit roundish; it will average quite large and uniform in size; skin, bright yellow, with bright red cheek; flesh, yellow, quite juicy, yet firm, good quality. Will not begin to decay as soon as most varieties, freestone. It now promises to be one of the most valuable market peaches for its season, which is the middle of September, or a little earlier.



Late Crawford, September 20th, 1895.



Golden Drop, September 25th, 1895.

Late Crawford. Tree, strong vigorous grower, moderately hardy; fruit very large, roundish; skin yellow, with a fine dark red cheek; flesh deep yellow, red at the stone, juicy and melting, with a very rich and excellent vinous flavor. Ripens latter part of September; freestone; one of the most valuable market peaches.

Jacque's Rareripe. Tree, strong vigorous grower, quite hardy and productive; fruit large, roundish, compressed; skin dark yellow, mostly shaded with dull red, flesh yellow, red at the stone, juicy, slightly subacid, freestone. Latter part of September.

Golden Drop. Tree a moderately vigorous grower, hardy in woody and fruit buds, very productive; fruit medium or a little above, round; skin yellow, sometimes shaded with carmine in the sun; flesh yellow, sometimes a little dry, but of quite good quality, especially for canning purposes, freestone. Ripens the last of September.

Hill's Chili. Tree of small willowy growth, very hardy in wood and fruit buds; a very productive annual bearer; fruit large, dull yellow, shaded with dull red, very downy; flesh yellow and of fair quality, freestone; good for canning; one of the most reliable varieties grown.

Crosby. Tree of low willowy growth, very hardy in wood and fruit buds, productive; the fruit is roundish, medium size, bright orange yellow, splashed with streaks of carmine on the sunny side; flesh yellow, juicy sweet, mild flavor, freestone. Ripens here on young trees last of September.

Lemon. Tree very vigorous, hardy, and the most wonderfully productive of any variety tested by me up to present date; fruit very large, oval, pale lemon yellow, of good quality, sweet and rich; one of the best flavored when canned, freestone. Ripens first week in October.

Smock Free. Tree vigorous and productive, although the tree requires more age than many other varieties before it produces heavy crops, about the same as the Crawford's in this respect. Fruit large, oblong; skin light orange yellow, mottled with red; flesh bright yellow, red at the stone. A splendid variety for shipping to distant markets.

Salway. Tree vigorous and productive; fruit medium to large; skin greenish yellow, suffused with red; flesh greenish yellow, good quality. Ripens last of October. The latest peach that can be grown in this locality with profit. This season they were not quite all ripe when the first frost occurred October 20th.

The most profitable varieties this season were Alexander, Early Crawford, Barnard's Early, Tyhurst, Late Crawford, Hill's Chili, Lemon and Smock.

The varieties most hardy in fruit buds are Alexander, Barnard's Early, Tyhurst, Hill's Chili, Crosby and Lemon. The latter ripens rather too late for the most parts of Ontario. Perhaps the two best varieties for unfavorable localities would be the Tyhurst and Hill's Chili. Where these two sorts cannot be grown, I think there would be little use of planting any other kinds.

Hints on the Cultivation of the Peach.

The peach tree is more tender than the other standard fruits grown in Ontario. We must therefore give it the most favorable location we can find.

Location. For the best success of the peach we must have a high, sandy or gravelly loam near a body of water. This must be naturally well underdrained to the depth of ten or fifteen feet. A northern slope is preferred. If such conditions cannot be secured, it is useless to go into the cultivation or the peach extensively with the expectation that it will meet with that measure of success desirable.

It is true many farmers throughout Ontario could plant a few trees for family use, and with proper care obtain a crop of fruit in favorable seasons. For this purpose plant such hardy kinds as Tyhurst and Hill's Chili on the north side of a building or on the northern slope of a hill. Never select the south side of a building, as that is not a favorable location for any tree not perfectly hardy. The sun's rays reflecting from a building will injure the wood of any tender tree standing near enough to catch the reflected heat.

Our method of planting and cultivating, which I see no reason to change, is about as follows: Select medium size trees, one year old from the bud. Shorten in the roots, and cut off all side branches of the top if there is good strong buds on the main stem. Cut this back to two or two and a half feet in height. Each succeeding spring we thin out superfluous branches, and shorten in the new growth nealry one-half until the trees begin to bear fruit in quantity. When the trees bear large crops of fruit they do not make such long growth of wood, and require less pruning.

Cultivate often and thoroughly, from early spring until midsummer. If no other crop is grown among the trees, sow to rye about the 1st of September; this will form a covering for the soil during winter, and some food for the trees when ploughed under in early spring. The rye also absorbs some of the surplus moisture during the growing autumn season, which prevents a late growth of wood on the trees that would otherwise take place. If we expect to have the trees go through the winter uninjured, we must have the wood ripened up thoroughly when cold weather sets in. The soil among the trees should not be ploughed deep at any time after the roots have made sufficient growth to be in danger of being disturbed by the plough.

One of the most important considerations in cultivating any orchard is to stir the soil, always to about the same depth, the roots are not then disturbed to any injurious extent.

W. W. Hilborn.

Southwestern Experiment Station,
Leamington, Ont.

GRAPES.

Tested at the Wentworth Experimental Station: M. Pettit, Winona, Experimenter.

Species: E. Æstivalis R. Riparia; L. Labrusca; H. Hybrid; X. Cross.
Size: S. Small; M. Medium; L. Large.
Form: L. Long; S. Short; Sh. Shouldered.
Compactness: C. Close; L. Loose; S. Straggling.

Shape of berry: O. Oval; R. Round.
Color: B. Black; P. Purple; R. Red; W. White L. Light; D. Dark.
Seeds: S. Small; M. Medium; L. Large.

Variety.	Vine.			Bunch.		Berry.						
	Origin.	Species.	Foliage.	Form.	Compactness.	Size.	Shape.	Skin. Color.	Skin. Thickness.	Flesh. Pulp.	Flesh. Flavor.	Seeds. Number and size.
1 Adirondac	Uncertain	L	weak	L	C	L	O	B	thin	tender	best	
2 Alvey (Hagar)	E. X. V. Maryland	EH	healthy	L Sh	L	S	O	B	thin	none	sweet, vinous	2, s.
3 Agawam (Rog. 15)	Black Hamburg X Native Mammoth. E. S. Rogers, Salem, Mass	LH	thick	S	L	L	R	D R	thick	soft	sweet, sprightly, aromatic	3-4, L.
4 Amber	Taylor seedling	X	weak	L	St	M	O	L	thick	tender	medium	
5 Amber Queen	Massachusetts	LH	thick	Sh	C	M	O	P	thin			
6 August Giant	Hamburg X Marion, Mass	RH	very strong.	Sh	C	L	O	B	thin	tender		
7 Barry (Rog. 43)		LH	healthy	S	C	L	R	B	thick	tender	sweet, pleasant	
8 Black Pearl	Clinton Seedling	R	healthy	S	C	M	R	B	thin		very sour	
9 Brighton	Concord X Diana Hamburg. Jacob Moore, Brighton, N. Y.	LV	thick	L Sh	L	L	R	R	thin	very little.	sweet, aromatic and vinous	
10 Catawba	North Carolina	L	medium	L	C	L	R	R	medium	slight	rich, vinous, musky.	3, M.
11 Cottage	Concord Seedling	L	healthy	S	C	M	R	B	thin		medium	
12 Creveling	Columbia Co., Pa	LH	healthy	L	S	L	O	B	thin			
13 Diana	Catawba Seedling	L	healthy	Sh	C	L	R	R	thick		musky.	
14 Dracut Amber	J. W. Manning, Dracut, Mass	L	thick	S	C	S	R	R	thick	hard		
15 Duchess	White Con. X Del. or Walter. A. J. Caywood, Newburgh, N. Y.	LH	medium	L	C	S	R	W	thin	none		1-2, S.
16 Eldorado	Con. X. Allen's Hy		healthy	L	St	L	R	W	thin	tender	best	few.
17 Empire State	Hartford X Clinton L X	R	medium	L	C	M	O	W	thick		medium	
18 Eumelan	Chance Seedling	E	medium	M	C	M	R	B				
19 Goethe, Rog. (No. 1)	Rog. Hyb	H	healthy	Sh	C	L	O	L	thick	tender	very fine	few.
20 Jefferson	Concord X Iona	L	thick	L Sh	C	M	R	R	thin			

GRAPES.—*Concluded.*

TESTED AT THE WENTWORTH EXPERIMENTAL STATION: M. PETTIT, WINONA, EXPERIMENTER.

Variety.	Vine.			Bunch.		Berry.						
	Origin.	Species.	Foliage.	Form.	Compactness.	Size.	Shape.	Skin. Color.	Skin. Thickness.	Flesh. Pulp.	Flesh. Flavor.	Seeds. Number and size.
21 Lady	Concord Seedling	L	healthy	S	C	S	R	W		tender		
22 Lady Washington	Con. X Allen's Hy	H	healthy	Sh	C	L	R	W	thin	tender	medium	
23 Lindley (Rog. 9)	Golden Chasselas X Wild Mammoth	LH	strong	L	L	M	R	R	thick			
24 Marion	Pennsylvania	R	thin	S	L	S	R	B	thin			
25 Martha	Concord Seedling	L	light	Sh	L	S	R	W	thin	pulpy		1-2, S.
26 Massasoit (Rog. 3)	Roger's Hybrid	LH	healthy	Sh	S	L	O	R	thin	tender		
27 Missouri Riesling	Taylor Seedling		healthy	S	C	S	R	W	thin		medium	
28 Moore's Early	J. B. Moore, Concord, Mass., Concord Seedling	L	thick	S	C	L	R	B	medium	hard		
29 Moore's Diamond			healthy	S	C	M	O	W	thin	tender	good	
30 Noah	Seedling of Taylor, Ill	R	strong	L	C	M	R	W	thin	hard		
31 Perkins	Massachusetts	L	thick	S	C	M	O	P	thick	pulpy		few & S.
32 Prentiss	J. W. Prentiss, Pultney, N. Y., Seedling of Isabella	L		S	C	M	O	W	medium			
33 Rebecca	Chance Seedling, N. Y. State	L	weak	S	L	S	O	W	thin	none		small.
34 Requa (Rog. 28)		LH	strong	S	C	L	R	R	thin			
35 Salem	Hamburg X Wild Mammoth	LH	strong	Sh	C	L	R	R	thick			large.
36 Taylor	R. X. L	RL	strong	S	C	S	R	W	thin	none		
37 Vergennes	Chance Seedling	L	strong	L	C	L	R	R	thick			
38 Wilder		LH	strong	Sh	C	L	R	B	thick	slight		
39 Worden	Seedling of Concord	L	strong	Sh	C	L	R	B	thin			
40 Wyoming Red		L	strong	S	C	S	R	R	thin	hard		

WENTWORTH STATION. RECORD FOR YEAR 1895.

GRAPES.

Variety.	Origin.	When planted.	Soil.	Cultivation.	Fertilizers used.	Winter protection.	Weather favorable or unfavorable.
Agawam	Rog. Hybrid	1887	Clay	Ploughed twice and cultivated frequently.	none	No protection.	unf'vr'ble.
Brighton	Con. X Diana, Ham	1882	"		.....		favorable.
Concord	E. W. Bull, Con., Mass.	1874	"		stable manure		"
Catawba	North Carolina	1883	"		"		"
Delaware	Unknown	1874	"		"		"
Lindley	Rog. Hyb	1887	"		"		"
Moore's Early	Con. Seedling	1887	"		"		too dry.
Moyer	Chas. Reid's seed	1886	"		ashes & st. man.		"
Niagara	Con. X Cassady	1882	"		stable manure		favorable.
Worden	Con. Seedling	1884	"		"		"
Wilder	Rog. Hybrid	1884	"		"		dry.

GRAPES.—*Continued.*

Variety.	Date of maturity.	Date of gathering. (Berries first and last.)	Yield.	Grade. Per cent. Class 1.	Class 2.	Class 3.	Average price.	Remarks.
			lb.				cts.	
Agawam	Oct. 4	Oct. 15	4½	4½	....	....	4½	Injured by spring frost.
Brighton	Sept. 7	Sept. 9	16	15	1	....	4	
Concord	" 12	" 25	17	17	....	....	3	
Catawba	Oct. 21	Oct. 21	19	16	2	1	3¼	Frosted before fully ripe.
Delaware	Sept. 5	Sept. 12	11	11	....	....	4½	
Lindley	" 2	" 15	21	21	....	....	4½	
Moore's Early	Aug. 24	" 2	5	5	....	....	5	
Moyer	" 22	Aug. 28	13	9	3	1	5⅓	
Niagara	Sept. 12	Sept. 20	23	22	1		3⅔	
Worden	" 2	" 10	21	20	1	....	4	
Wilder	" 18	" 30	17	15	2	....	3¾	

NOTES OF EXPERIMENTAL WORK.

I beg to submit the following report of the work that is being carried on at the Wentworth Experiment Station.

There have been about 160 trees and vines added to those planted last year. The greater part of these are grapes and plums, some pear, cherry and currants.

The grape crop at this station was very fine, both quantity and quality were above the average. We had no mildew or any form of fungus. Even the Salems were heavily laden with fine clean fruit.

The thrip was the only insect enemy that appeared to any extent and considerable damage was done to some of the thin leaved varieties. It was our intention to test the coal oil emulsion for this pest but the work was neglected.

Careful experiments were made with Bordeaux mixture on apples, pears, plums and grapes. There was no perceptible difference except in Flemish Beauty pears, owing to the absence of fungus.

I cannot report very satisfactory results from spraying with Paris green for codling moth. A Greening orchard carefully sprayed, with several trees left for check gave very little in favor of spraying, A greater portion of the first brood may have been destroyed, but the second hatching which destroys the pears and apples when they are about full grown, did considerable damage on apples, Bartlett and Keiffer pears. We hope in a few years to be able to report valuable information in reference to some of the Japan plums which are awakening considerable interest among the fruit growers on account of the earliness of some of them.

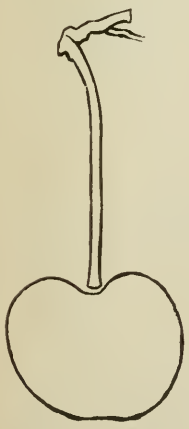
We have also started a series of experiments with fertilizers to stimulate the growth of young treee and vines and trust in a few years we may have some valuable information to report.

M. PETTIT,
Experimenter.

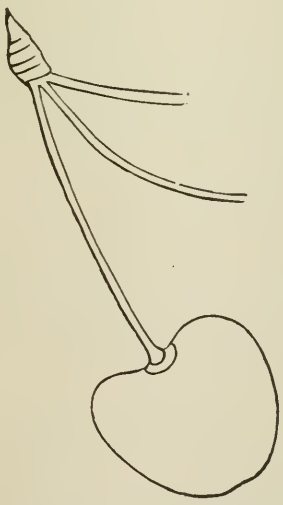
NOTES ON SOME LEADING VARIETIES OF CHERRIES.

BY THE SECRETARY.

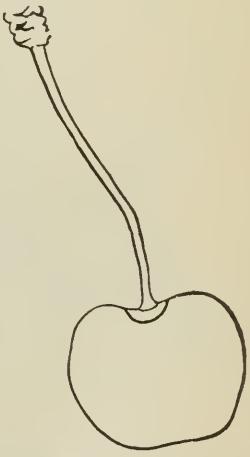
The first really good cherry of the season with me is the Governor Wood. True, we have Early Purple preceding it about a week or so, but it is not a meaty cherry, and is



GOVERNOR WOOD.



BLACK TARTARIAN.



KNIGHT'S EARLY BLACK.

nearly always eaten by the birds before it is harvested. The Governor Wood, on the other hand, is not so subject to the ravages of the birds, and is a delicious white-heart

cherry of the best quality. This year it began ripening about the 16th of June and continued until about the 26th.

It is a productive variety also; one tree this season yielded seventy-two quarts and that might be looked upon as about half a full crop, for about half was destroyed by the frost. The tree, of course, is a full-grown one, being about thirty years planted. The variety originated in Ohio.

There are several other varieties of white cherries ripening about with the Governor Wood, which we will speak of more fully some other time, *e.g.*, the Rockport, American Amber, Coe's Transparent and Elton. The latter is a particularly fine flavored white-heart cherry of great value for canning, except for its soft flesh and its tendency to rot in wet seasons.

The Black Tartarian is the most prominent of our black-heart cherries, and, although of Russian and West Asian origin introduced into England about one hundred years ago, succeeds admirably in the Niagara peninsula. The fruit is of tender flesh, dark colored and juicy, of large size, rich flavored and delicious. Birds as well as men have a special preference for this cherry, and its tender flesh especially invites the former. Therefore, in order to secure the crop, we find it necessary to begin harvesting them on the green side. The picking of this cherry began with me this year on June 22nd, and the fruit not picked hung until the 30th.

The Tartarian cannot be called a heavy bearer, because the fruit does not grow in such clusters as that of some other varieties, but the large size to a certain extent makes up for the number on the cluster.

Of the other black-heart cherries, we will briefly refer to the Knight's Early Black, which ripens a few days in advance of the Tartarian. The fruit is not quite so long and is a little more obtuse heart-shaped; it is a little more even in outline, otherwise it much resembles the latter variety. The fruit is inclined to grow singly and this makes the gathering rather slow; besides it is less productive than the Tartarian. A full grown tree at Maplehurst yielded about thirty quarts in 1895, and this may be called a full crop.

The Black Eagle succeeds the Tartarian, beginning to ripen this season about the 28th of June. It is a delicious heart cherry, if anything smaller than the Knight's Early Black. The fruit is grown in somewhat sparse clusters, and the tree is only

A Branch of the Black Eagle.

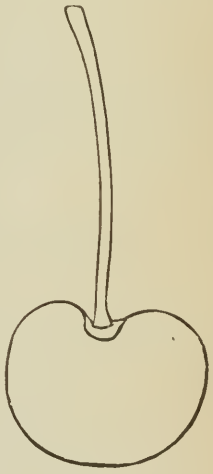
Napoleon Bigarreau.

moderately productive, our large trees giving about forty quarts each. The accompanying engraving will show the clusters on a branch of this variety.

Of the Bigarreau cherries, the leading variety for productiveness is the Napoleon Bigarreau. It is the habit of this variety to load in great clusters, a great advantage in harvesting, provided the fruit is free from rot. This variety is unfortunately very subject to this disease, and sometimes almost a whole crop is destroyed by it. Otherwise this is the most productive of all varieties, a hundred quarts being a very ordinary yield from a full grown tree. We add an outline of the cherry in order to show the exact size. The skin is white, well shaded with light red, and the flesh is very firm. It is one of the largest of cherries and altogether well fitted for the commercial orchard.

The Yellow Spanish is another magnificent variety, often exceeding in size even the Napoleon, especially when the crop is light, as indeed it too often is. It too is sadly subject to rot. In the year 1894 I did not gather a single basket, from this cause; every cherry rotted before ripening. This year, however, the case was wholly different,

A Branch of the Yellow Spanish.



Yellow Spanish.

and it exceeded all past records of productiveness. One fine old tree yielded 132 quarts of the finest sample of cherries, and here again I have brought our camera into use to show a branch from this very tree, and the beautiful clusters of large-sized fruit. The skin of this cherry is yellowish white, with deep red blush, and the flesh firm and also yellowish in color.

This variety is the favorite one at Maplehurst for canning for home use. It began ripening this year about July 1st. I add an outline in order to give a more correct idea of the size as grown in 1895.

Of this same Bigarreau, or firm-fleshed type, we have two excellent black cherries ripening late in the season, viz., the Tradescant's Black Heart, an old and well-known European variety of dark purple skin and firm flesh and good quality. It is a very pro-

ductive cherry and one that carries well to market. The other is the Windsor, a new variety of Canadian origin, which is rapidly gaining favor with planters as an excellent late black cherry. The tree of this variety at Maplehurst is only three years planted. It is evidently a strong, vigorous grower, and quite productive. The cherry is obtuse, heart-shaped, dark red in color, and the flesh quite as firm as that of Tradescant's Black Heart. The quality seems excellent for all purposes. It ripens on the 5th of July, and hangs on the tree until the 13th. Cherries picked and left in the house keep without change two or three days. The fruit is borne in clusters which are very easy to gather.

The Early Richmond is a valuable cherry for pies and for canning. The tree is hardy and may be grown much farther north than the Heart and Bigarreau cherries above mentioned, besides it is profitable to grow for market. One difficulty attends it wherever grown, and that is its susceptibility to black knot.

There is also a large fruited Montmorency offered for sale which seems to be larger and later than the Early Richmond. It is a promising variety.

My Wragg trees have been planted five years, and are this year heavily laden with fruit. This variety has no very great merit to commend it that I can see, for the fruit is scarcely as thrifty as the Late Kentish, and the fruit is no better, if as good. Possibly it is hardier, and possibly more productive; certainly this season it does outbear that variety. The color is a darker red than the Kentish, and the flavor scarcely as good.

The harvesting of the cherry crop is not so great a difficulty as many imagine. A good man will easily gather fifty quarts a day, and with some varieties, such as the Napoleon, he will gather one hundred quarts or more. The usual cost of picking cherries, therefore, is from one and one-half cents to two cents per quart.

They are usually packed in eight or twelve quart baskets; but this season I packed the finest in a more fancy package, viz., in boxes with sliding covers, holding about three quarts each. The cherries were packed from the bottom, paper of a suitable color being first laid against the lid. The cherries were rowed neatly against the top and the box turned over and bottomed.

THIRD ANNUAL MEETING OF THE BOARD OF CONTROL.

The Board met at Woodstock on Tuesday, December 10th, 1895. There were present the President, the Secretary, the Official Visitor, and Messrs. A. M. Smith and A. H. Pettit.

The minutes of the last meeting were read and approved, and the report of the work done by the Executive was also read and approved.

An informal report of his experiments in spraying, according to the scheme formulated by this Board, was presented by Mr. A. H. Pettit. He had first called a meeting of the farmers and fruit growers at each of the thirty points at which the experiments were to be made, and addressed them, explaining fully the nature of the work to be undertaken. He then asked them to appoint a committee to select such an orchard as was believed by them to be best suited for the experiments under contemplation. This having been done, he interviewed the different pump makers of the province and invited them to a public test of their pumps side by side in his own orchard, and agreed to use such pumps as were proven by actual experience to be suitable for the work. He then chose three young men who accompanied the three spraying outfits. Work was begun in the southern division on the 24th of April, and on the 26th in the northern division, continued by a succession of visits to each point until the sixth application had been made. The longest time that any tree in the thirty points selected was left unsprayed was an interval of fourteen days. After all this work had been accomplished, Mr. Pettit visited the various points to take notes for his report. In a few places no results were observed, owing to the frost and drouth, but in most instances he could observe, first, an improvement in the foliage,

second, that the apples were cleaner and larger, and third, less injury from the codling moth on the sprayed than on the unsprayed trees. A detailed report of the work done by Mr. Pettit will appear elsewhere.

It was ordered that samples of fruit be put up by the various experimenters for the Industrial Fair, Toronto, and for the Imperial Institute, London, England, the former to be afterwards forwarded to the Ontario Agricultural College, Guelph.

It was ordered that the Secretary be authorized to purchase forthwith a microscope and camera, to be used under the directions of the Board, the expense to be met out of the grant of the current year.

It was agreed that experiment stations be located at the following places during the year 1896, in accordance with the recommendations of the official visitors: Maitland, Whitby, St. Catharines, Freeman, Nantye.

Ordered that the Secretary and the Horticulturist of the Ontario Agricultural College constitute a committee of nomenclature, and shall be responsible to this Board for the correct naming of varieties on exhibition.

The report of the official visitor to stations, by Mr. H. L. Hutt, Horticulturist, Ontario Agricultural College, Guelph, was then presented, as follows:

INSPECTION OF FRUIT EXPERIMENT STATIONS.

It has been my pleasant duty to visit and inspect during the summer all of the stations already established. Each station was visited at the most opportune time for taking note of the particular kind of fruit grown there. At every station, I am glad to say, good work is being done, and valuable information is being gained, which will be given to the public in the annual reports from the experimenters.

In company with Mr. L. Woolverton, Secretary of the Ontario Fruit Growers' Association, I also visited a number of other places in different parts of the province where it is thought desirable that stations should be established, our object being to learn as much as possible about the fruit interests of these sections and find competent fruit growers to undertake experimental work.

The following is a brief report on visits to the stations established last year:

The Wentworth Station.

May 23rd, 1895. Visited the Wentworth station, where Mr. M. Pettit, Winona, is making a specialty of grapes. Found everything under good cultivation and well cared for. Spraying with copper sulphate solution had been done before the appearance of the foliage, and also with the Bordeaux mixture before the appearance of blossoms.

The severe frosts of the previous two weeks had killed the new growth on the young vines at the north end of the place; the large vineyards, however, at the back and more under the lee of the mountain had escaped with little or no injury. Pears and plums also at the front were seriously thinned out with the frosts, while a block of one hundred Greening apple trees close under the mountain was white with bloom.

The plot of ground devoted to the planting of new varieties was in first-class condition, and the young trees and vines were doing nicely.

Sept. 25th. Visited Mr. Pettit's again at the height of the grape harvest when all hands were busy picking, packing and shipping grapes. In most parts of the vineyard the vines were heavily laden and presented a magnificent sight. From the twenty acres in bearing Mr. Pettit estimated the crop would be between sixty and seventy tons. This was being disposed of at the rate of about two tons per day, shipped mostly to regular customers or retail dealers in various parts of the province. In this way Mr. Pettit realizes much better prices than by shipping to commission men in the large and usually over-stocked markets.

Owing to the light crop of fruit in all parts of the country, except where it was protected from frosts by the proximity of some mountain or large body of water, the prices this year are unusually good, and fruit growers in such favored sections are making up for the low prices obtained in other years when fruit has been abundant.

The South-Western Station.

Sept. 26th. Visited the station at Leamington, in Essex county, where Mr. W. W. Hillborn is making a specialty of peaches and strawberries. Our visit to this station last year was on the 15th of June, during the strawberry season; this year we deferred it till September, to see it at the time of peach harvest.

Although peaches are grown to a certain extent all over this county, they are most extensively grown along a narrow ridge of land in the southern part of the county running parallel with the lake shore. "The Ridge," as it is called, is about five or six miles long, and varies from half a mile to a mile and a half in width. The soil is a light, dry sand, so dry, in fact, that for the last two years the strawberries growing on it have in many cases been killed out during the hot weather of mid-summer. Its peculiar adaptability, however, to peaches makes it valuable, and in consequence of this being the only section in Ontario where the peaches were not injured this year, the price of land along "The Ridge" has risen nearly $20 per acre.

Mr. Hillborn has about 100 acres planted with peach trees, and expects to put out twenty five acres more next spring. As yet most of the trees are young and not in bearing. From five acres bearing this year he picked about 900 baskets, which were sold by contract for 84c. per basket.

He has under test over 100 varieties, about forty of which will be bearing next year. Full reports as to the value and productiveness of each of these varieties will be given from year to year in the annual report, so that valuable information for peach growers may soon be looked for from this station.

The Georgian Bay Station.

On August 29th, after two days spent among the fruit growers of Walkerton and Port Elgin, and a sixty-mile ride across country on the bicycle, we reached our plum experiment station at Clarksburg. By taking note of the orchards along the road, the influences of the waters of the Georgian Bay upon the climate of that section might readily be seen. In all of the orchards inland and in many places up to within a mile or two of the shore, the spring frosts had destroyed the blossoms and there was little or no fruit. Along the bay shore, however, many orchards might be seen laden with fruit, and in some cases the branches were propped with poles to enable them to bear their load.

The orchards of Mr. John Mitchell, our experimenter at Clarksburg, being a couple of miles from the bay, had suffered somewhat from the frosts, and were bearing about half a crop. The varieties of apples bearing most heavily were Kings, Baldwins, Ribston Pippins, Cayuga Red Streaks, and Greenings Northern Spys had not bloomed at all. Duchess of Oldenburgs, which were then all harvested, had been a good crop, and had brought $2.50 per barrel in St. Mary's and Stratford.

Plums, of which fruit Mr. Mitchell is making a specialty, were seriously injured by the frosts. Those varieties which had escaped uninjured and were bearing heavily were Lombards and Duane's Purple. The fruit of these was finding ready sale at $1.25 per basket. Mr. Mitchell has about five hundred thrifty young plum trees in bearing, and in the new plot devoted to variety tests, thirty-seven varieties were planted this spring, three trees of each. Besides these, he is testing a few of the hardier varieties of peaches, pears and cherries.

Mr. Mitchell is a thorough cultivator, sprays his orchards carefully for insects and fungous diseases, and takes a lively interest in the fruit industry of his section.

The Simcoe Station.

August 30th. Visited the Simcoe station, where Mr. G. C. Caston, of Craighurst, is testing hardy varieties of apples, pears and cherries and some of the small fruits. Craighurst being somewhat inland, the fruit in this section was seriously injured by the spring frosts. In Mr. Caston's apple orchard there was about a quarter of a crop. The varieties bearing most heavily were Wealthy, Spitzenburg, Baxter, Golden Russet, and Tolman Sweet. Some young Wealthy trees were heavily laden, proving well the hardiness and productiveness of this variety.

Good cultivation and thorough spraying, such as Mr. Caston gives his orchards, may accomplish wonders in most seasons in producing fine fruit. But in seasons like this, where the frost takes everything, cultivation and spraying can avail nothing, except to keep the trees in a vigorous and healthy condition for future crops. It was on account of the scarcity of fruit in Mr. Caston's orchard this year that he was unable to make the display at the Toronto Exhibition he otherwise would have made.

Among his young trees of apple and pear, planted this spring, there was not a failure, all of them at the time of our visit showing a good growth. The currant and gooseberry bushes planted this spring were also doing well. Mr. Caston has got a number of Russian varieties in the nursery row, ready for planting another year.

The Bay of Quinte Station.

September 4th. We arrived at Trenton, and after wheeling out four miles on an up-hill, dusty road, we reached the home of Mr. W. H. Dempsey, the manager of the fruit experiment station for this section. Mr. Dempsey's specialty is apples. His orchard covers about forty acres, of which nearly all the trees are in bearing. Mr. Dempsey and his father, the late P. C. Dempsey, always had a taste for originating and testing new varieties, and on this account Mr. Dempsey's orchard probably contains a greater number of varieties than any other apple orchard in the province. He has growing over 150 varieties, twenty-three of which are carefully described and reported on in last year's report.

The spring frosts, so injurious in most places, had done very little damage here. It was estimated that his crop would be over 1,500 barrels, and as most of the apples this year are of unusually good quality, the greater part of the crop will be A1 marketable fruit.

To enable him to pick and ship his fruit to advantage, Mr. Dempsey has built a large two-story fruit house, the walls of which have been made frost proof, so that apples may be stored in it all winter, and sold in the best markets.

"Maplehurst" Fruit Farm.

When giving an account of visits to the different fruit experiment stations already established, and which we expect in time to contribute valuable information to Ontario fruit growers, it may be well to mention "Maplehurst," the fruit farm of Mr. L. Woolverton, Secretary of the Ontario Fruit Growers' Association, and editor of *The Canadian Horticulturist*, for probably no other fruit farm in the province has afforded more information to fruit growers than that of the editor of *The Horticulturist*.

"Maplehurst" is about a mile west of the village of Grimsby, and consists of a 100-acre strip of land about a mile long, running from the mountain to the lake. It embraces a great variety of soils, from a light, loamy sand to a heavy clay. This, in connection with the wonderfully favorable climate and shelter of the mountain, makes it well adapted to the production of all kinds of fruits grown in Ontario, and all of these are grown here more or less extensively, as the entire farm is planted to fruit.

Besides growing fruit for profit, Mr. Woolverton plants largely every year as a student of horticulture. Nearly every new fruit promising to be of any value is given a trial. Last spring about 130 new varieties were planted, embracing pears, peaches, plums apricots, cherries and grapes. By planting annually in this way, and keeping careful records, Mr. Woolverton, as editor of *The Horticulturist*, is enabled to advise his readers with authority as to the merits of new fruits constantly being brought before the public. His collection of varieties of cherries is one of the largest in the province and it is hoped we may glean valuable information from his reports on these.

PROPOSED NEW STATIONS.

The following notes are on visits made to different persons with a view to finding suitable places for new stations:

Martin Burrill, St. Catharines, Lincoln County.

Visited May 24th, 1895. Situated four miles west of St. Catharines, and half a mile from the lake. Farm of twenty-five acres, seventeen acres in fruit. Soil very variable, from light loam to heavy clay, partly rolling.

The following fruits are being grown: Four acres, or about 1,000 peach trees, in bearing, twelve varieties; two acres peaches, newly planted; 200 pear trees, mostly in bearing, twelve varieties; 150 cherry trees, six varieties, mostly Early Richmonds; fifty quince trees, two varieties; 800 grape vines, about twelve varieties; about half an acre of strawberries and other small fruits; few apples.

Mr. Burrill is an energetic young man, enthusiastic in fruit growing. He takes an active part in the local farmers' institutes, and has made for himself a reputation as a thoroughgoing fruit grower.

Stanley, Spillet, Nantye, Simcoe County.

July 9th, 1895. Three miles north of Lefroy station and twelve miles south of Barrie—lot of two and a half acres, but more can be bought from an adjacent farm—soil, a moist, sandy and clay loam, well adapted to growing gooseberries. Land all well underdrained, heavily manured and thoroughly cultivated. The following fruits are grown: Gooseberries, raspberries and strawberries, and a few trees of plums, pears and cherries. Most of the ground is devoted to growing gooseberries, of which he has about 700 bushes of twenty different varieties. Plot of new varieties put out this spring.

His Champions were remarkably prolific, and his Downings very large. All had been sprayed. Mr. Spillet uses a small Clarksburg pump on a barrel, mounted on a hand-cart. He also used flower of sulphur for mildew. His bushes are planted six by four feet apart and trained in the bush form.

Mr. Spillet is an elderly man, and has taught in the neighboring rural school for the last thirty years, but is resigning this year. He is a careful, reliable man, enthusiastic in gooseberry growing, and should make a good experimenter; was busy when we called making drawings of the different varieties of berries. He grows gooseberry plants every year for E. D. Smith, of Winona.

Rev. E. B. Stevenson, Freeman, Halton County.

Mr. Stevenson is a Methodist minister, now stationed at Freeman, near Burlington. Nearly all of his strawberries, however, are grown on the fruit farm of his father, near Guelph, which he visits frequently.

Mr. Stevenson has all his life been growing and testing everything new in the line of strawberries, and is, without doubt, one of the best authorities in the province on the varieties of strawberries.

He has about 200 varieties under test, forty-two of which were reported on in last year's report. He is also giving attention to the production of new varieties by artificial pollination.

A. E. Sherrington, Walkerton, Bruce County.

August 27th, 1895. Short distance from G. T. R. station, outside town limits, on land 160 feet above the town. Farm of seven acres, but expects to buy more. Soil, chiefly clay loam and uniform. Most of the farm planted with apples and plums. Has about 240 apple trees in bearing—seven or eight of the leading varieties. Some of the newer varieties top-grafted. Plums, about forty-five trees, about twelve varieties. Pears, about thirty-five trees, mostly Bartlett, Flemish Beauty and Duchess. About half an acre in strawberries and raspberries.

Mr. Sherrington is an intelligent, progressive man, and being an apple buyer, is well acquainted with the fruit interests of his section. He says that in 1893 about 40,000 barrels of apples were shipped out of that section.

He has also a large apiary, managed according to modern methods.

A. W. Peart, B.A., Burlington, Halton County.

August 31st, 1895. Farm about one and one-quarter miles east of Burlington station and one and one-half miles from lake shore; 150 acres of land, twenty of which are in fruit. Soil, variable, from a gravel to a clay loam. There are under cultivation the following fruits:

Apples, ten acres; 400 trees, twenty-eight varieties, mostly in bearing; pears, 300 trees, about eight varieties; young trees coming into bearing; grapes, three acres, twenty-two varieties, just in bearing; peaches, fifty trees, three varieties; plums, six acres, twenty varieties, young or coming into bearing; currants, one acre, six or eight varieties. Other small fruits grown for home use.

The whole farm and all the fruits are under first-class cultivation.

Mr. Peart has been spraying for the past ten years, and his trees and vines were nearly all well loaded with a fine crop of fruit.

Personally Mr. Peart is a man of exceptional qualities. He is a graduate of Toronto University, and is a progressive and very energetic fruit grower. He is a careful observer and an exact experimenter on his own account. He is public spirited and posted in the fruit interests of his locality. He is at present Secretary of the Burlington Horticultural Society, which he helped to organize, and president of the county farmers' institute.

The Burlington district is one of the leading fruit districts of the province, and has carried off the prize for district exhibition at Toronto for a number of years. At the time of the World's Fair at Chicago, this district contributed largely to the grand display of fruit made by Ontario. The fruit sent from Burlington to Chicago was gathered and shipped at the expense of the local Horticultural Society.

R. L. Huggard, Whitby, Ontario County.

Sept. 3rd, 1895. Farm about half way between the town and G. T. R. station. Property in two blocks of ten and twenty-five acres, some distance apart. The ten-acre block is all in fruit, and he expects to buy more land adjoining. Soil, clay loam, uniform and well drained. The following fruits are being grown: Apples, about 100 trees in bearing

and a number of young trees coming on. About forty-five varie ies, generally two trees of each variety. Pears, about 400 trees, mostly six years old and coming into bearing, others newly planted. About fifty varieties. Plums, about 300 trees coming into bearing. About fifty varieties. Grapes, about thirty varieties, one or two vines of each. Not profitable in this section. A few small fruits, as currants, raspberries, etc.

Orchard under fair cultivation and well sprayed with Bordeaux mixture and kerosene emulsion. Some trees top-grafted.

Mr. Huggard is of about middle age, enthusiastic in fruit growing, intelligent and energetic. Has acted as agent for Messrs. Stone & Wellington.

E. W. Beman, Newcastle, Durham County.

Sept. 3, 1895. Farm one and a half miles west of Newcastle and three miles east of Bowmanville. Sixty-eight acres of land, bordering on the lake, about twenty acres in fruit. Soil, a rather heavy clay loam, draining towards the lake. The specialty at this place is pears. Of these Mr. Beman has about thirteen acres, mostly in bearing. He has some of the largest pear trees to be found in the country. Some old Flemish Beauty trees will yield this year six or eight barrels. He had growing at one time nearly 250 varieties of pears, but many of these blighted, and he has now about 150 varieties, and generally three or more trees of each variety.

Apples, about thirty varieties; 150 old trees and about 270 younger trees coming into bearing, many of them top-grafted with new varieties. Plums, about 200 trees, newly planted. Fifty varieties. Grapes do not succeed well here, but he has about thirty varieties, two vines of each.

Small fruits only for home use.

Mr. Beman is a man about sixty years of age. A very careful, thorough and painstaking fruit grower, well read and posted in the fruit interest generally. Has been spraying for the past ten years. The effect of spraying was very marked on his large Flemish Beauty trees. Sprayed trees were loaded and perfectly clean. On an unsprayed tree close by the fruit was cracked and covered with scab.

His younger orchards Mr. Beman keeps well cultivated, but his older pear trees are kept in sod to avoid blight. The grass is mowed and left as a mulch, and ground manured as well. Nearly all of his trees were loaded with fruit, which he grades properly and ships to Montreal in barrels.

Harold Jones, Maitland, Grenville County.

Sept. 5th, 1895. Lives two miles from Maitland, seven miles east of Brockville and five miles west of Prescott. Farm consists of 265 acres, bordering on the St. Lawrence. Soil, clay and clay loam, best along the river front, somewhat rocky at the back of the place.

Mr. Jones has about six acres of apple orchard, four acres of trees thirteen years old, nicely in bearing. Had 400 barrels from them last year. Two acres of old orchard, rather rough. One hundred and seventy-five new trees put out last year. Altogether about fifteen varieties; the greater portion of the trees are, however, Fameuse. Bearing orchard is kept in sod and manured heavily. Has been spraying carefully with Bordeaux mixture.

Mr. Jones is about thirty-five years of age, intelligent and enthusiastic in fruit growing. Visits Mr. Craig, of Ottawa, every year, and keeps posted as to insect enemies, etc. Is fighting the Case-Bearer in his orchard under the direction of Mr. Fletcher. He is public spirited and holds office in a number of benevolent societies.

GOOSEBERRIES.

Descriptive List of Varieties Tested at Simcoe Station, Stanley Spillet, Nantye, Experimenter.

Size: S, Small; M, Medium; L, Large; VL, Very Large.
Form of Berry: R, Round; Ov, Oval; Ob, Oblong.

Color: R, Red; B. Black; W, White; G, Green; Y, Yellow.
Season: E, Early; M, Medium; L, Late.

VARIETY.	Plant.					Berry.						Value scale 1-10		Remarks.
	Origin.	Foliage.	Vigor Scale 1-10.	Productiveness scale 1-10.	Freedom from mildew 1-10.	Size.	Form.	Skin.	Color.	Flavor.	Season.	Dessert.	Market.	
1 Autocrat	English	fair	7	8	8	V L	Ob	thin	G	V G	L	10	10	Subject to dropping of foliage.
2 Champion	American	very good	9	10	9	M	Ov	thin	G W	fair	M	6	8	
3 Chautauqua	foreign	fair	8	....	8	S	Ov	M	G W	good	M	9	10	
4 Downing	American	fair	8	9	9	M	R	M	G W	good	M	9	8	
5 Lancashire Lad	English	fair	7	....	8	L	Ov	thin	R	V G	E	10	10	Slow growth.
6 Pearl	Am. and English	good	9	9	9	M	R	M	G W	good	M	9	8	
7 Queen	German	good	9	....	9	L	Ov	M	G W	good	M	9	10	
8 Red Jacket	American	very good	9	....	9	L	Ov	M	R	good	L	9	10	
9 Triumph	English	fair	7	8	8	V L	Ov	thin	G W	good	M	9	10	Very promising, sprayed.
10 Whitesmith	English	fair	8	8	7	V L	Ob	thin	G W	good	M	9	10	Grand variety when sprayed.
11 Carnie's Golden	foreign	good	9	....	9	.....	..	.....	.....	.....	.....	....	....	
12 Crosby's Seedling	foreign seedling	good	9	....	9	.....	.....	.....	.....	.....	.....	....	....	
13 Crown Bob	English	good	....	....	....	.....	....	.....	.....	.....	.....	....	....	
14 Champion	English	good	9	....	....	.....	.....	.....	.....	.....	.....	....	....	
15 Columbus	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	....	....	
16 Phœnix	Scotch	good	....	....	....	.....	.....	.....	.....	.....	.....	....	....	
17 White Crystal	American	very good	9	....	9	.....	.....	.....	.....	.....	.....	....	....	
18 Large Golden Prolific	.....	good	9	....	....	.....	.....	.....	.....	.....	.....	....	....	
19 Rumbullion	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	....	....	
20 Golden Prolific	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	....	....	

Notes.

The second attack of mildew was very severe, and though the spray-pump was kept going, considerable damage was done to the young growth of wood and foliage. It is this second or fall growth of this fungus that produces winter spores. These survive the winter and this is why spraying before the leaves open in spring is so important. During this attack I was able to observe the effects of shade upon the growth of this fungus

A row of nursery stock to the north of a high board fence so situated that the sun did not reach them till late in the afternoon suffered most severely, while opposite a door in this fence and when the rows extended past the fence, the same varieties were not nearly so much damaged. A row of bushes to the east of a dense windbreak of spruce also suffered severely, so did a row on the west side of a tight fence. This demonstrates that shade at the expense of a free circulation of air is not desirable for gooseberries.

Champion, (Eng.), Carnie's Golden, (Scotch), Crosby's Seedling, (apparently of foreign origin), Large Golden Prolific and White Crystal all planted this spring are apparently very vigorous and therefore promising. Time is needful to fully determine their character. Columbus, Golden Prolific and Rumbullion made such poor growth that very little can be reported concerning them.

Next summer I purpose spraying two each with Bordeaux mixture and flower of sulphur while two shall be left unsprayed, also to test the effect of shade with a free circulation of air.

Confusion is likely to arise from the fact that some of our American seedlings are named for existing English varieties, Champion and Red Jacket for example.

It is a pity that originators of new varieties do not consult some list of existing varieties before naming their seedlings. I think it will pay them to do so for a bad name is sometimes fatal.

Weights of Gooseberries.

I have carefully weighed some of the leading varieties and give weights :

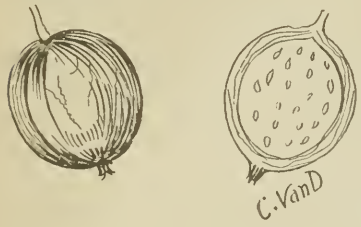
Downing—12 berries weighed $1\frac{1}{2}$ oz.
Pearl—12 berries weighed $1\frac{3}{4}$ oz.
Champion—12 berries weighed $1\frac{2}{3}$ oz.
Triumph—12 berries weighed $2\frac{3}{4}$ oz.
Autocrat—12 berries weighed $2\frac{2}{3}$ oz.
Whitesmith—12 berries weighed $2\frac{3}{4}$ oz.

I should like to get correct names for seed pulp, also for a more solid substance lying between this seed-pulp and skin proper. This substance remains quite firm till the berry is ripe, when it becomes quite soft and sweet. I am of the opinion the nearer we come to the native seedling or wild variety the thinner this is. Cultivation thickens it and lessens the size of the seed cell.

The Leading Varieties.

An insect, probably the Gooseberry Midge (*Cecidomyia Grossulariæ*) has been more destructive this year, than usual. This insect deposits an egg in the berry which produces a small maggot, causing a premature ripening and falling of the fruit. Its depredations are confined to the so-called thinner skinned varieties, such as Downing, Pearl and Champion. The reason seems to be that the improved or English varieties have a smaller seed cell in proportion to the size of berry. This is especially true of the Triumph, which has only from fifteen to twenty seeds, while the Downing has from thirty-three to forty. The slender white fibres attaching the seeds to the two main veins at the sides of the berry are longer in the Downing, etc., throwing the seeds and seed pulp nearer the surface than in the English varieties. This part of the berry

between the seed pulp and the skin proper, which can easily be peeled off, is more solid and firm than the seed pulp and obviously offers a greater obstacle to the operations of the insect.



DOWNING.

Downing. It would, no doubt, seem to fruit-growers almost superfluous to give any lengthened description of Downing, but I find many would-be planters who know nothing about it nor any other variety. Bush strong, upright grower; stems very strong and armed with strong thorns, abundant at the base of the stem; peduncles slender; pedicle long and strong, one to two berries to each; berries smooth, greenish-white, roundish-oval or nearly globular; fine flavor; prolific, yielding for nine consecutive years five quarts to the bush. This year about half an average crop. Mildew proof. Any man who will produce as good an all-round berry as the Downing or Pearl, mildew proof, and which shall average one inch by three-quarters, or what will be equal to this measurement, shall deserve the gratitude of the nation.

Pearl. The Pearl, described by some experimenters as of foreign origin and requiring spraying for fungi to succeed, is, no doubt, as the Downing is, a cross of a native seedling upon some English variety, as is claimed for the Pearl by its originator

CHAMPION.

I find it for four years perfectly mildew proof. The description given of Downing is generally applicable to the Pearl with the difference that the latter is a little larger berry and the bush a more vigorous grower. Indeed no other variety equals it in this respect except Champion and probably Red Jacket.

Champion. Champion in several features resembles the Houghton, this is especially the case in stem, shape of berry and frequently having three berries to one peduncle. The berries are also slightly pubescent. This berry is said to be a cross of Downing on a wild Rocky Mountain berry, probably of the species Hirtellum.

Bush an upright, vigorous grower, but becomes drooping with the weight of fruit; stems slender and long, smooth; axiliary spines long, slender and weak; peduncles slender, having from one to three berries to each peduncle, very short and slender; berries slightly pubescent; color greenish white; oval, skin very thin; seeds from twenty-five to thirty; flavor not so good as Downing; very prolific, apparently mildew proof.

TRIUMPH.

Triumph. Triumph is certainly of English parentage, planted in the fall of 1893. Bush an upright grower, fairly vigorous; stems medium length, stout, armed with long, sharp, strong thorns at the axils; generally three in number; berry smooth, oval, thin skin; very small seed cell containing from 15 to 22 seeds; color greenish-yellow; flavor good, apparently prolific; where spraying is practiced it is valuable.

Autocrat or *Conn*, planted in 1890, shows plainly its European blood. Stems very strong, long, with a pendant habit of growth; vigorous, not very prolific; berry smooth, oblong, dark green; seed cells small, but not so small as Triumph. Taken altogether not very valuable, but worthy of further trial; not disposed to mildew, except occasionally; flavor good; season late, seeds too green to be counted.

Chautauqua and *Queen.* These two varieties, planted in 1893, resemble in wood, leaf, habit of growth, color, and appearance of fruit the Triumph. That they are wholly or partially of English origin is more than probable.

Lancashire Lad, planted in fall, 1892, but has been moved once. Slow grower of very crooked wood. Berry decidedly pubescent; dark red, oval; like all the English varieties peduncle short; pedicle short and stout; flavor very good. We need a red berry larger than Houghton, but I fear that this berry will never supply this need.

Red Jacket is apparently what is claimed for it, a native seedling (*Cynosbati*). Bush vigorous, rather sprawling grower, somewhat resembling Smith's Improved; berry smooth, rather thick skin, color red, flavor good. Planted fall of 1893. I have strong hopes that this variety will fill a long felt need—a large, red berry combined with great vigor and productiveness.

Whitesmith, a well known and valuable English variety. Bush an upright, vigorous grower; berry smooth, whitish-yellow, oblong, fine flavor, prolific. Must be sprayed for mildew.

Permit me to explain my inability to give pounds per bush this year. Last summer, before I knew of undertaking experimental work, my bushes were all mounded up for the purpose of growing nursery stock, and this spring were torn to pieces pretty severely, so that there was not the necessary amount of wood to grow fruit on, but though I shall continue this work in the future I shall stake off six bushes of every variety to experiment with. The weight of fruit per bush is not always a certain test of extraordinary productiveness. I saw seven quarts picked from a single bush and other bushes in the garden that might give ten quarts, but the bushes had been suffered to grow to an enormous size, and needed pruning badly, and the fruit was very small for the variety.

My method of pruning is at present, until I get more light to have about six stems, sometimes less; these are cut away and their places supplied with new wood at the end of three good crops from the old. The bush is kept well cleared out beneath and the body so pruned out that the hand can be inserted in all directions. At first I cut out the centre of the bush, keeping the centre like a vase or inverted umbrella, but I found the

WHITESMITH.

fruit scalded badly, I may add that in comparatively low-growing varieties I find it better not to cut back the new wood too much as it induces a great growth of small, weak wood, which is not desirable. I am of the opinion that summer pruning would be an advantage the cutting out of all superabundant new growth at this season would induce the stronger growth of the remainder. I cannot see why the wood should be allowed to ripen before being pruned out.

STANLEY SPILLETT,
Experimenter.

STRAWBERRIES.

SIMCOE EXPERIMENT STATION.

This is a year of disappointment and failure for the strawberry grower. The plants wintered well and made a remarkable growth during the warm, unseasonable weather of the first part of May. The first blossoms were opening and the fruit stems were well filled, when the weather suddenly changed and for several nights we had from six to eight degrees of frost followed by cold winds and bright sunshine during the day. This was varied on one day by a fall of snow. The apple and pear trees were white with bloom, and we had a spectacle never before seen in my recollection—the trees laden with snow and white with bloom at the same time. The effect on the strawberries was most disastrous. Not only the blossoms, but the leaves, were frozen. On opening the petals of the undeveloped blossoms it was found that every blossom on the fruit spurs was frozen, and the only fruit that could be expected now would be upon the later plants upon which the fruit spurs were not yet developed. With abundant moisture and favourable weather these might have given nearly half a crop, though undersized and inferior. But instead, we have had a severe drought that is not as yet broken at this writing—June 24—and so the strawberry crop of '95 must be classed as almost a total failure

Under these circumstances it is impossible to make a reliable estimate of the forty varieties under test here, or to give an accurate account of their good or bad qualities,

for the reason that some were more forward than others and thus suffered more from the frost. Then some varieties have a habit of developing their blossoms nearly together, while others continue to develop blossoms for a much longer period, and in this way were not so much injured. For instance, the blossoms on Gov. Hoard, Grenville, Seneca Queen and Timbrell were so entirely frozen off that I could not get a specimen of the fruit.

However I have endeavoured to make a few notes on the different varieties, so far as I am able to judge of their merits, with one season's trial under very unfavorable conditions.

NOTES ON VARIETIES.

Parker Earle (S). One of the most promising of the new sorts. Foliage, moderately healthy, a little affected with rust; fruit stalk, long; form, oblong; color, red; quality, medium; berry, firm, would be a good shipper; season, medium. With rich soil and high culture this berry would be very productive. For the commercial grower it is no doubt an acquisition.

Beder Wood (S). Vigor, medium; foliage, healthy; stalk, long; color, pale red; size, medium to large; quality, good; productiveness, medium; firm enough to ship well. Said to be early, but no earlier than many other varieties here.

Woolverton (S). This variety has not nearly fulfilled my expectations The blossoms are rich in pollen. It is therefore a good fertilizing sort to plant with pistillates, but many of the plants do not bear the first year after planting. It is a poor bearer. Berry, large, oblong, bright red, moderately firm; stalk, long; quality, good; foliage, very healthy; season, medium; needs further trial.

Saunders (S). This variety did not make many plants, and many of those planted failed, so that there were few left. Under these conditions I would not say much about it until given another year's trial. Berry, large, bright red, conical; quality, excellent; foliage, very healthy; stalk, medium; worthy of trial.

Little's 44 (P). Berry, fine, handsome, large; quality, good; firm enough for local market; fruit stalk, long; foliage, very healthy; not productive enough for the commercial grower.

Leader (S). Berry, medium to large; form, round, often flat; quality, good; stalk, medium; foliage, healthy; a medium bearer; needs further trial before recommending it for general planting.

General Putman (P). Berry, large; color, light pale red; quality, good; stalk, long; foliage, medium; not productive; needs further trial.

Woodruff (S). Berry, medium; color, red; firm enough to ship fairly well; stalk, medium; foliage, medium; promises, under favorable circumstances, to produce a fair crop.

Lovett (S). Berry, medium to large; color, bright red; form, oblong; quality, good; firm enough to ship; plants vigorous with healthy foliage; fruit stalk, long; not productive.

Cameronian (S). A large dark red berry; firm enough to be a good shipper, but of poor quality and lacks productiveness.

Moore's Early.—Only succeeded in growing one of two plants of this variety. It is a bright, attractive berry of good quality, but no earlier than Crescent. Berry, firm, ound, a little flattened at the tip; bright, attractive color; quality, good; cannot judge f its bearing qualities.

Bubach No. 2 (P). Berry, large; form, irregular; moderately firm · quality, good; productiveness, medium; fruit stalk, short; foliage, very healthy; a good standard sort, and should have a place in every plantation.

Lady Rusk (P). A promising variety. Berry, medium; quality, fair; form, somewhat conical, though often irregular; stalk, medium; in firmness will compare well with-

many other varieties and promises to produce well ; holds its fruit well through the season and seems to stand dry weather better than many other sorts ; foliage, healthy ; a good grower.

Hatfield (P). A large, handsome berry ; only one or two plants lived ; needs further trial.

Edgar Queen (P). Berry, medium to large ; quality, fair ; color, red, handsome ; firm ; fruit stalk, long ; a promising variety.

Captain Jack (S). Berry, firm ; color, bright red ; quality, medium ; form, conical, resembles the Wilson in shape ; fruit stalk, long ; plants vigorous, but inclined to rust badly later in the season ; productiveness, only medium ; needs another season's trial.

Some of the plants sent here were wrongly named. Care should be taken to avoid this, as it is sure to cause confusion One or two varieties seem to be Crescent under other names ; one lot labelled Wilson turned out to be Crescent. I received the Hatfield from two places, and they were different varieties. The one I have sketched is a large berry, with very healthy foliage. The other is a small berry, of poorer quality, a good grower, but the foliage is a little inclined to rust ; a great bearer. The fruit somewhat resembles Crescent, but not so large. If the fruit were large, it would be a decided acquisition, as it bids fair to outstrip all others in yield. It is a pistillate variety.

Haverland (P). A rampant grower ; healthy foliage ; productive ; withstands drouth better than any other variety ; one of the best. Its only fault is that it is too soft when fully ripe to ship well. Everyone who plants for home use should have this variety. Excellent for dessert.

Miami and *Martha* are very much alike ; very prolific but too small.

Great Pacific and *Shaw*. Only one or two plants of each of these pulled through. Will have to give them further trial.

Daisy is a medium sized berry, smooth, round and handsome, with healthy foliage. If, on further trial, it produces well, it will be well worthy of cultivation.

Mrs. Cleveland is a rampant grower with healthy foliage, but the berry is to soft for anything except home use. It is a poor bearer, and may be regarded as a failure. I would not recommend it.

Governor Hoard, *Seneca Queen*, *Middlefield*, *Timbrell*, *Advocate*, *Auburn*, *Florence* and *Eureka* have nothing so far to recommend them. They will have another season's trial, however, before being placed on the rejected list. Greenville is little better. Swindle is appropriately named ; it is simply no use.

There are none among the new varieties tested that equal *Crescent* for yield, except perhaps *Parker Earle*. The latter is decidedly a better shipper. *Haverland*, though rather soft for long distance shipments, is one of the best for health and vigor of plant.

From my experience so far, if the old *Wilson* could be grown as it used to grow here, and we could prevent the rust by spraying, I would not discard it for any other, as it is certainly without a rival as a shipping berry.

We cannot go far astray in planting for profit Crescent and Haverland, with Parker Earle as a pollenizer. These three varieties would no doubt fill the bill. For the home garden, *Crescent*, *Haverland*, *Bubach*, *Saunders*, *Sharpless* (the latter only where the soil is very strong and rich), and for a sixth, Daisy or Woodruff. These would be a good selection for canning and dessert.

I must again repeat what I have already said, that the testing of the varieties having been made under such disadvantageous conditions this year, nothing conclusive can be stated against or in favor of most of the varieties mentioned. Another year's trial may develop qualities in many of these varieties not now apparent. I propose to try the effect of Bordeaux mixture in preventing rust, blight, etc., as soon as fruiting is over.

G C. Caston,
Craighurst.

STRAWBERRIES—

Fruit Stalk: Long or Short; above foliage or concealed by it.
Size: S, Small; M, Medium; L, Large; Add average length and breadth in inches.
Form: B, Broad; C, Conical; D, Depressed; I, Irregular; L, Long; O, Ovate; R, Round.

Number.	Varieties.	Plant. Sex.	Origin	Foliage. Healthy or liable to rust.	Fruit stalk.
1	Aroma	S	Seedling of Cumberland, Kansas	very healthy	M to L
2	Arrow	P	From Haverland, Wisconsin	healthy	L
3	Afton	P	Chance seedling, New York	healthy	M
4	America	S	From Great American, Virginia	healthy	L
5	Barton's Eclipse	P	From Longfellow, Kentucky	some rust	M
6	Beverly	S	From Miner's Prolific, Mass	healthy	M to L
7	Bubach	P	Mr. J. G. Bubach, Ill	very healthy	M
8	Bederwood	S	Mr. B. Wood, Ill	some rust	M to L
9	Boynton	P	From Crescent x Sharpless, New York	healthy	M
10	Briggs	S	From Chas. Downing, Rhode Island	some rust	M to S
11	Bisel	P	From Wilson, Illinois	some rust	M
12	Brandywine	S	From Glendale & Cumberland, Pa	healthy	M
13	Belle	S	Mr. Thompson, Va	very healthy	M
14	Beede's No. 1	S	G. F. Beede, N.H	very healthy	M
15	Beauty	S	Unknown	very healthy	M to L
16	Clyde	S	Seedling of Cyclone, Dr. Stayman, Kansas	very healthy	M to L
17	Cyclone	S	Seedling of Crescent, Mr. Cruse, Kansas	very healthy	L
18	Cruse's No. 9	S	Seedling of Cumberland, Mr. Cruse, Kansas.	healthy	M to L
19	Chairs	S	From Bubach & Sharpless, Maryland	healthy	M
20	Charlie	P	From mixed seed, Mr. Thompson, Va	healthy	M to L
21	Dr. Arp	P	Mr. Stone, Ill	healthy	M to L
22	Della K	S	Seedling, Sharpless, E. B. Stevenson, Canada	healthy	M
23	Enhance	S	From Windsor Chief and Sharpless, Mr. Young, Ohio.	healthy	M
24	Edgar Queen	P	Mr. B. O. Curtis, Illinois	some rust	M
25	Epping	P	By Geo. D. Dow, N.H	very healthy	M
26	Effie May	S	Unknown	very healthy	M
27	Edith	P	Chance seedling, by Mr. Thompson, Va.	some rust, healthy	M
28	Equinox	S	Seedling, Mt. Vernon, Mr. Thompson, Va.	some rust, healthy	L
29	Fremont	S	Seedling of Belmont, G. F. Beede, N.H	some rust, healthy	M to L
30	Gandy	S	Cross of Jersey Queen with Glendale	healthy	M to L
31	Greenville	P	Chance seedling, by Mr. Buechly, Ohio	very healthy	S to M
32	Glenfield	S	From Warfield & Glendale, by Dr. Stayman, Kansas.	healthy	M to L
33	Gov. Hoard	S	By F. W. Loudon, Wis	healthy	M to L
34	Gertrude	S	Chance seedling, C. C. Stone, Ill	healthy	S to M
35	Gandy Belle	S	Unknown	healthy	M
36	Haverland	P	Mr. Haverland, Ohio	very healthy	L
37	Howard's No. 25	S	From Haverland & Belmont, Mr. Howard, Mass.	some rust, healthy	M
38	Howard's No. 41	P	From Haverland & Belmont, Mr. Howard, Mass.	healthy	M to L
39	Hatch Ex.Stn.No. 24	S	From Hatch Ex. Station, Mass	healthy	S to M
40	Hunt's No. 3	S	Mr. Hunt, N.J	very healthy	M
41	Huntsman	P	Mr. Huntsman, Mo	some rust, healthy	S to M
42	Hanson	S	Mr. Stone, Ill	some rust, healthy	M
43	Hiawatha	S	From Aroma, by Dr. Stayman, Kan	very healthy	S to M
44	Iowa Beauty	S	Mr. C. P Walworth, Iowa	healthy	M
45	Ivanhoe	S	Seedling of Prince of Berries, by G. W. Trowbridge, Ohio.	healthy	M
46	Jucunda Improved	S	From Old Jucunda, by A. B. Gerbert, Pa.	some rust, healthy	S to M
47	Jersey Queen	P	Unknown	very healthy	S

By E. B. Stevenson, Freeman, Ont.

Color : B, Bright; C, Crimson; D, Dark; L, Light; R, Red; S, Scarlet.
Flesh : F, Firm; S, Soft,
Season : E, Early; M, Medium L, Late.

Number.	Plant. Vigor. Scale 1-10.	Plant. Productiveness. Scale 1-10.	Berry. Size.	Form.	Color.	Flesh.	Flavor (See Thomas.)	Season.	Value. Scale 1-10. Dessert.	Market.	Remarks.
1	8	8	L	...	.....	... .	.....	L	8	9	A good one.
2	8	6	M to L	.....	.. ...	.....	....	M	7	7	Not as good as Haverland.
3	10	9	M	.....	.....	.....	.....	M	6	8	Very like Warfield.
4	5	8	M	.... .	.....	.....	.. . .	EM	9	8	Further trial.
5	8	6	M to L	.....	.. ...	.....	....	M	7	7	Worth trying.
6	6	7	L	.....	.....	.....	.....	M to L	8	9	Does well in some parts.
7	7	9	L	.....	.....	.....	.....	M	8	10	One of best.
8	7	9	M	.....	.....	.....	.....	E	6	9	Near.
										5	Distant, a good early.
9	9	9	M to S	.....	.....	.....	.....	E to M	6	7	Same as Crescent.
10	4	6	L	.....	....	.....	.....	M	8	8	Can't stand hot, dry weather.
11	8	9	M to L	.... .	....	.....	....	M	8	9	A good market sort.
12	9	8	M to L	.....	....	... .	.....	M to E	9	9	Worth trial.
13	8	7	L	.....	.....	.....	.....	L	8	8	A fine one.
14	8	6	M	.....	.....	.. ..	.....	M	10	8	Further trial.
15	8	8	M to L	.....	.....	.....	.. ..	M	7	7	Worth a trial.
16	10	10	M to L	RC	BS	VF	good	E	9	10	One of the best market ones.
17	9	8	M	C	S	F	good	E	8	8	A good one.
18	8	7	L	R	R	F	good	L	8	7	Another trial.
19	7	8	M	.....	.....	Soft...	good	E to M	8	5	Of little value.
20	8	7	M	.....	.....	.....	....	M	8	6	Further trial.
21	7	6	M	.....	.....	.....	.. ....	M	6	6	Of little value.
22	8	9	L	C	S	.....	.....	M to L	8	9	Further trial.
23	9	8	L	.....	.....	VF	....	M to L	6	9	A good one for market, firm.
24	7	5	M	.....	.....	VF	.....	M to L	7	6	Not much good.
25	8	7	M	.....	.....	.....	.....	M	6	8	Further trial.
26	8	6	M	....	.....	.....	....	M	7	8	Further trial.
27	8	8	V L	.. .	R	S to M	fair	M to E	7	7	Very large berries, somewhat soft.
28	8	9	M to L	.....	.....	... ...	very good	VL	9	8	Further trial.
29	8	8	M	.....	.....	..... .	....	M	8	6	Will give another trial.
30	8	6	L	.....	.....	.....	.....	L	8	8	Shy bearer but good.
31	9	10	L	.....	BR	M	good	M	8	10	Near.
										6	Distant, one of best.
32	7	6	M	.....	DC	F	very fine.	M	9	8	Fine quality.
33	8	6	L	.....	.....	F	good	M to L	9	7	Shy bearer, good quality.
34	8	8	M	.....	.....	M	fair	E to M	6	6	Further trial, worth trying.
35	8	7	L	.....	.....	F	good	E to M	8	8	Another trial.
36	9	10	L	... .	.....	.....	good	E	8	10	Near.
										6	Distant, one of best.
37	9	6	L	.....	.....	.....	good ...	M	7	7	Further trial.
38	8	7	L	.....	BC	M	good	E to M	9	7	Further trial.
39	7	6	L	.....	DR	S to M	fair	M	7	6	Further trial.
40	9	8	M to L	.....	.....	F	good ...	M	8	8	A good one.
41	8	7	L	.....	DC	M to S	m to good	M	8	6	Another trial.
42	6	6	M	.....	.....	.....	medium..	M	6	6	Not valuable.
43	10	7	M	... .	.....	.....	medium..	M	7	8	A good one.
44	8	8	L	.....	DS	.....	very good	M	10	7	Fine home berry.
45	7	7	M	.....	BR	.....	good	M to L	6	7	Amateur's berry.
46	8	7	L	.....	BS	F	good	M	9	7	Not productive enough.
47	8	8	L	.....	BS	M	good	VL	8	9	One of best lae

STRAWBERRIES.

Number.	Varieties.	Plant. Sex.	Origin.	Foliage. Healthy or liable to rust.	Fruit stalk.
48	Judsonia	S	Unknown	some rust, healthy	M
49	Jarabolo	S	Seedling of Mrs. Cleveland, by Dr. Stayman, Kansas	healthy	M
50	Klickita	P	Chance seedling, by E. W. Cone, Wis	some rust	M
51	Kansas Prolific	S	Seedling of Warfield, Dr. Stayman, Kansas.	very healthy	S to M
52	Leader	S	By late J. B. Campbell, Mass	healthy	M to L
53	Longfield	P	Seedling of Warfield, Dr. Stayman, Kansas.	very healthy	M to L
54	Lovett's	S	From Crescent & Wilson, J. H. Norris, Ky.	some rust, healthy.	M to L
55	Magnate	P	From Warfield, by Dr. Stayman,	healthy	M
56	Maple Bank	P	Seedling of Wilson, parentage by Mr. Stevenson, Ont	some rust, healthy	M
57	Michel's Early	S	Chance seedling, thought from Crescent, by J. G. Michel, Ark	healthy	S to M
58	Meek's Early	S	Mr. J. A. Meek, Ind	healthy	M
59	Muskingum	S	Mr. G. Kearns, Ohio	healthy	L
60	Mary	P	From Windsor Chief, by H. H. Alley, N.J.	healthy	M to L
61	Margaret	P	Seedling of Crawford by Mr. Crawford, Ohio	healthy	M
62	Marshall	S	Chance seedling, Mr. Ewell, Mass	some rust, healthy.	M to L
63	No Name	S	Unknown	healthy	M
64	Northern	S	Unknown	very healthy	S to M
65	Ohio Centennial	P	Unknown	healthy	S
66	Oberholtzer's No. 3	P	Mr. Oberholtzer, Ohio	healthy	M
67	Ona	P	From Crescent x Sharpless, Mr. Kilbourne, Minn	some rust, healthy	M
68	Parker Earle	S	From Crescent x Munson's No. 8, Mr. Nimon, Texas	some rust	M to S
69	Phillips	S	From Crescent x Sharpless	some rust but h'lthy	S to M
70	Princess	P	By Mr. J. C. Kramer, Minn	healthy	M
71	Prince of Berries	P	From Jersey Queen	healthy	L
72	Princeton Chief	P	Unknown by Mr. Pascharsky, Ill	some rust, healthy.	L
73	Plow City	S	Seedling of Sharpless, C. C. Stone, Ill	healthy	M to L
74	Robinson	S	From Crescent x Chas. Downing by J. G. Robinson, Kansas	healthy	M to L
75	Rio	S	Seedling of Sharpless by Mr. Thompson, Va	healthy	S to M
76	Richmond	S	Mr. Thompson, Ohio	healthy	M
77	Southard	S	Chance seedling by Mr. Southard, Ohio	healthy	M
78	Saunders	S	By Mr. Little, Ont	some rust, healthy	M
79	Sunnyside	P	By Mr. C. S. Pratt, Mass	healthy	M
80	Snowball	S	By Mr. Cone, Wis	almost burnt up with rust	M to L
81	Scarlet ball	S	By Mr. Cone, Wis	healthy	M to L
82	Splendid	S	By Mr C. H. Summer, Ill	very healthy	M
83	Stone's Early	P	By Mr. Stone, Ill	healthy	M to L
84	Springdale	S	Seedling of Aroma by Dr. Stayman, Ka	very healthy	M to L
85	Tennessee Prolific	S	From Crescent x Sharpless by J. C. Hodges, Tenn	very healthy	M
86	Timbrell	P	Chance seedling by H. S. Timbrell, N.Y.	healthy	M
87	Van Deman	S	From Crescent x Capt. Jack by J. C. Bauer, Ark	some rust, healthy	M
88	Warfield	P	From Crescent x Wilson, B. C. Warfield, Ill	healthy	M to L
89	Williams	S	Seedling of Sharpless from Ont.	some rust, healthy	S to M
90	Woolverton	S	Mr. J. Little, Ont	healthy	M to L

—*Concluded.*

Number.	Plant.		Berry.						Value. Scale 1-10.		Remarks.
	Vigor. Scale 1-10.	Productiveness. Scale 1-10.	Size.	Form.	Color.	Flesh.	Flavor. (See Thomas.)	Season.	Dessert.	Market.	
48	7	7	M to L	.....	C	M	good	M	7	7	Further trial.
49	8	7	L	.....	.....	M	good	M	8	8	Worth a trial.
50	8	6	M to L	.....	DS	F	good	M	7	6	Not much value.
51	9	7	M	.....	DR	M to S	good	E to M	6	8	Worthy of trial.
52	5	5	L	.....	DR	F	very good	E	10	7	Further trial.
53	9	9	M to L	LC	.....	F	medium..	L	7	9	A good one.
54	9	8	M to L	.....	DC	F	medium..	M	6	8	Only medium.
55	8	6	M to L	LC	BS	F	very good	M	9	8	Worth a trial.
56	9	8	L	RC	.....	VF	good	M to L	9	8	A good one.
57	10	4	S	R	LS	M	medium..	E	6	8	Hardly worth growing.
58	8	4	M	.....	.....	M	medium..	E	6	8	Worthy of a trial.
59	8	7	L	.....	DR	M	good	M to L	8	6	Good one.
60	8	9	L	.....	BR	F	fair	M	7	9	One of the best, 1 year's trial.
61	8	7	L	R	BR	M	good	E	7	8	Further trial.
62	8	6	V L	.....	.....	F	good	M	8	7	Fine amateur berry.
63	8	7	L	.....	.....	F	good	E to M	8	8	Worth trying.
64	7	6	S	.....	.....	.....	good	E	8	6	Not valuable.
65	6	8	V L	.....	.....	M	good	M to L	9	6	A good one.
66	8	7	M to L	RC	BC	F	good	M	8	8	Worth a trial.
67	7	6	M to L	.....	BS	F	fair	E	6	6	Not worth much.
68	5	9	S	C	S	F	medium..	M to L	7	8	Hardly worth a trial.
69	9	7	L	RC	DR	F	medium..	M	7	6	Valuable.
70	7	6	M to L	R	S	F	good	M	6	7	A good one.
71	8	8	M to L	.....	.....	M	fair	M	6	8	A good one.
72	8	5	M	R	DR	M	medium..	L	7	7	Not valuable.
73	7	8	M to L	.....	.....	F	fair ...	L	7	8	Worth a trial.
74	8	8	M	RC	DC	M	good	M	6	8	Worthy of a trial.
75	9	8	M	.....	BR	F	good ...	E	7	8	A good one.
76	8	7	M	....	DS	F	medium..	M	7	8	Worthy a trial.
77	8	8	M to L	RC	DS	F	good ...	M	9	7	A fine one.
78	9	9	L	RC	BC	F	very good	M	9	9	One of the best.
79	8	8	S	C	L	F	medium..	M	7	8	Small, but worth trying.
80	7	4	M	.....	.....	M	.....	M	....	....	Not valuable on account of rus
81	8	6	M to L	.....	S	F	good	M	7	8	Further trial.
82	10	6	M	R	.....	M	medium..	M	6	6	Further trial.
83	7	8	S	C	S	M	fine	E	8	6	Worth trying.
84	8	7	M to L	.....	.....	.....	good ..	.....	....	....	Further trial.
85	9	9	M to L	.....	.....	M	good	M	8	8	A good one.
86	8	9	L	.....	.....	F	very good	V L	10	8	Well worth trying.
87	10	8	L	C	BC	F	very good	EE	10	9	Best extra early.
88	10	9	M	C	DC	F	good	E to M	7	9	One of best.
89	9	8	L	RC	DC	M	m to poor	M	5	8	Quite productive.
90	9	8	L	R C	DR	F	good	L	9	8	A good one, all should try it.

STRAWBERRY NOTES.

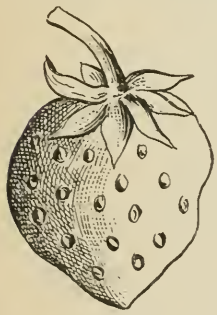
Halton Sub-Station.

It is almost impossible to make a report this year. The crop was so badly injured by a week's hard frost at blooming time, and that followed by a long season of hot, dry weather, that it was impossible for any variety to do its best. This fact must be kept in mind in what follows, especially in the illustrations. These are at least one-quarter smaller than they would have been if they had had a good shower during the time they were maturing The cuts are the exact size of berries that grew on the respective varieties this season of 1895. I shall first present six or eight of the best extra early and early sorts to be followed by eight or ten of the best medium varieties, and lastly by the best late kinds. These are selected out of some 140 of the best named kinds that are now before the public; the simple facts as they presented themselves are given with regard to each kind now offered to the readers of the *Horticulturist*. The Clyde did best of all; Beder Wood came next. Some of the varieties that had the flower stems and flowers frozen, sent up a secondary set, notably the Clyde and B. Wood. Some did not. The Haverland, Bubach and Van Deman were among those hurt the worst and did not recover, only producing a very few berries. What fruit there was, was small and ill-shaped; not typical berries of many of the kinds.

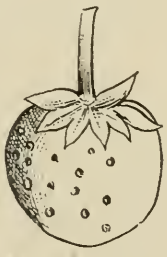
Early Varieties.

Van Deman (S.) One of the earliest, an extra early, is the Van Deman; a seedling of Crescent crossed with Capt. Jack, and it comes from Arkansas. The plant is a free grower, making a wide matted row, and when allowed to grow too thick rusts somewhat. The season is extra early, a few days before Michel's Early. Size: The fruit is large and very beautiful, a box of them fairly compelling you to look at them. The berries look as if varnished and set with golden seeds. They are a grand sight. One of the good things about them is, the quality is as fine as the look; they are first quality, and firm; and lastly, very productive. The best to fertilize are Haverland, Warfield, Bubach and other early pistillates. The great danger with the Van Deman is it is often caught by the frost it is so early to bloom and fruit. This is the fourth year of fruiting.

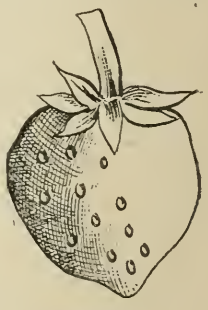
Michel's Early (S.) A chance seedling thought to be from Crescent by J. T. Michel of Arkansas. The plant is a wonderfully vigorous grower, making plants by the million.



Van Deman



Michel's Early.



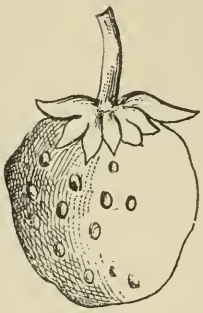
Margaret.

The season is very early, only a few days after the Van Deman. The size of fruit is small to medium; the quality is fair and medium in firmness. The great fault with it is it lacks in productiveness. If you could secure $1 per box they might pay, and yet in some soils and sections of the country it is said Michel's is more than average in productiveness; but where there is one favourable report there are more than nineteen unfavorable. It is not anything like as profitable as Van Deman or Beder Wood. Fourth year of fruiting.

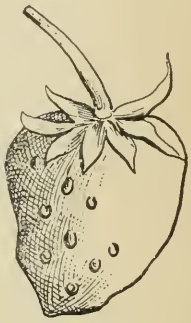
Margaret (P.) This is a seedling of the Crawford, by Mr. Crawford, the strawberry king of Ohio. The plant is a strong grower, healthy, and making runnets freely. The season is very early. Size of fruit is large and fine looking; quality, good; color, crimson; firmness, medium, and productiveness fair. This was the first season it fruited here, and as it was one of the most unfavorable seasons. I would like to make further trial before pronouncing on it, but it is very promising. It has not been introduced yet.

Stone's Early (P.) This is a seedling by Mr. Stone of Illinois. The frost and hot, dry weather succeeding was very hard on this variety. The plant is a healthy one, growing freely; the season is early; the size of the fruit was small this season, but that

STONE'S EARLY.



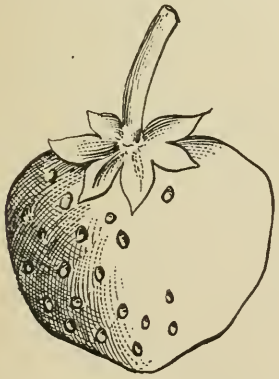
BEDER WOOD OR RECASTER.



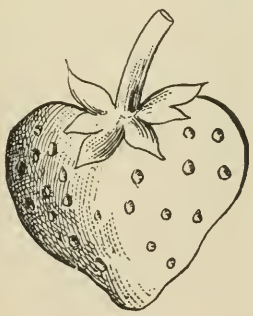
RIO.

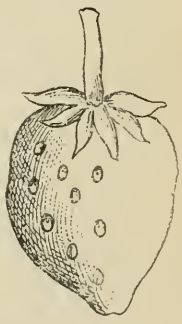
may have been owing to the dry spell just as it should have been at its best; the quality is fine; color, scarlet; it was not very productive; this was the first season it fruited here; must wait for further trial before deciding as to its merits.

Beder Wood (S.) or *Recaster.* A seedling by Mr. B. Wood, of Moline, Illinois. The plant is a good grower, making a wide row. It rusts somewhat when too thick. The season is early, among the earliest; the size of berry is medium to large. One fault it has, some of the berries do not ripen evenly, having a white underside. It is very rich in pollen and so a good fertilizer; the quality is only medium; firmness, medium; productiveness very good, in fact it is one of the most productive of all, certainly the most productive early variety. It was among the best this dry year. Fourth year of fruiting.



CLYDE.





CYCLONE.

Rio (S.) This is a seedling of Sharpless, grown by Mr. Thompson, of Virginia. The plant is a good healthy grower, making a good wide row. The season is second early here this year. Size of berry is above medium; bright red color; quality is good; medium in firmnesss. It is productive. This is first year of trial; must give it further trial; but I am very favorably impressed with it, and think it very promising.

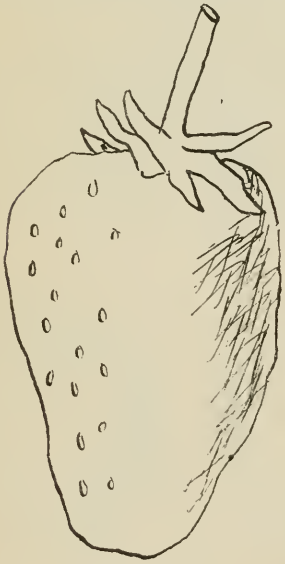
Clyde (S.) This is a seedling of the Cyclone grown by Dr. Stayman, of Kansas. The plant of the Clyde is perfect in every respect; it is very healthy and vigorous, not a spot of rust or trace of disease on it. It resembles its parent and the Haverland, but is stronger and more vigorous than either of them. The season is second early, continuing a long time. Size: it is large, no small berries; quality is good, and it is very firm; a bright dark scarlet in color, and one of the most productive. This season it stood far and away at the head, showing that it is a dry season berry; the strong plant with its roots going down so deeply, enables it to stand a dry time better than many others. I consider it one of the best, if not the best, general purpose berry that is now offered; have fruited it three seasons. I would advise all berry growers to plant some Clyde. The following is Michigan Experiment Station report of it: "Out of ten points: Productiveness, 9.8; quality, 8.5; firmness, 9.2. One of most promising."

Cyclone (S.) This is a seedling of Crescent-Cumberland, grown by Mr. Cruse, of Kansas. The plant is a strong, healthy, vigorous grower; no rust or disease; season, early; size, medium. The quality is good; glossy red; firmness medium, and very productive; a good one to plant with Haverland or Bubach, as it is a very early bloomer and continues a long time in bloom. It does not stand the dry weather as well as the Clyde, nor is the fruit as large; still it is a good one to plant for early.

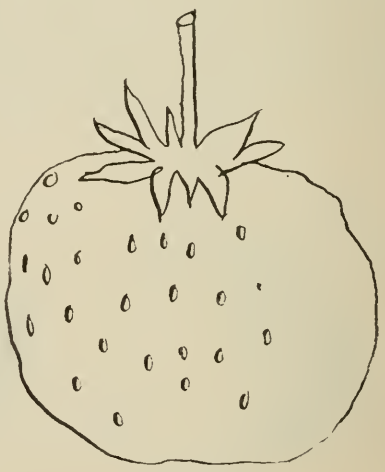
Mid-season Varieties.

In this paper I will give a list of the best varieties, the fruiting of which will be found to be mid-season.

In making these outlines typical berries are used, not monstrosities, but berries that would give a good idea of the general shape of the variety. I might have got larger specimens of all the varieties, but they would not have been types of the variety.



Haverland.

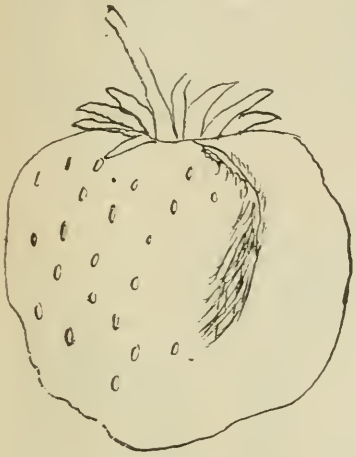


Bubach 5.

Haverland (P). A variety originating in Ohio. This is one to grow enthusiastic over. It is one of the best, if not the best of all; when one sees the ground covered entirely with fruit, from the first of the season to the very end of it, the originator may well be proud of it. It is magnificent in its foliage; most numerous in number of runners and enormous in quantity of fruit. The fruit is large to very large. Its only fault is that it is somewhat soft; of fair quality. It is certainly a berry for the home garden and near market. Perhaps not suited for long distance shipment. Color, rather

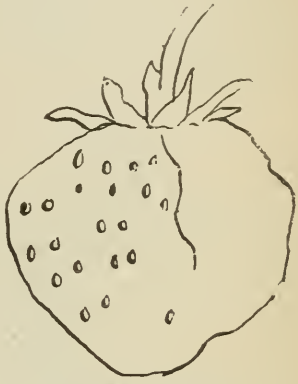
light. As a producer of fine large berries, nothing else with us equals it. It gives large fruit to the end of the season, and is one of the first ripe.

Bubach (P). Originating in Illinois. Here is another grand standby. The foliage is all anyone could wish for, both in thrift and color and health; not a trace of rust; it makes runners fast enough for a grand row to fruit. The fruit is remarkable for its size and fine color. We place it among the productive ones. Fruit enormously large and very showy; good quality; sweet. It is perhaps the very best for the home grower, and near market, always selling and bringing good prices when the market is glutted with Crescent and other trash.



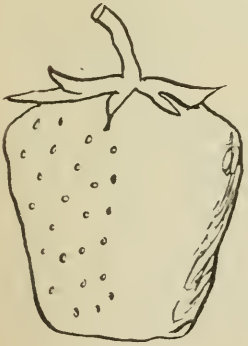
BUBACH 5.

WARFIELD.



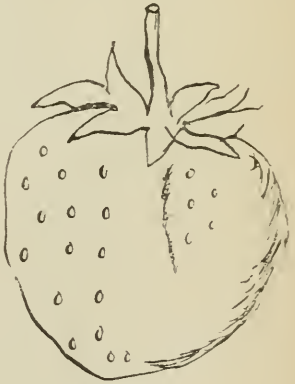
ANNA FORREST.

Warfield No. 2 (P). Originated in Illinois. This is a wonderfully strong grower and great producer of plants. It resembles the Michel's Early in this respect, making almost too many runners. It is very productive, we place it along with the Haverland in productiveness Fruit, medium to large in size, is one of the firmest in the berry—equal to the old Wilson in this respect. Quality good; color, a fine rich dark. The



DAYTON.

PRINCESS.



GREENVILLE.

berries are all perfect in shape, regular, no ill-shaped ones, and of a fine rich, dark color. It is one of the best, if not the best, for long shipment—carrying in good condition the longest distance to market.

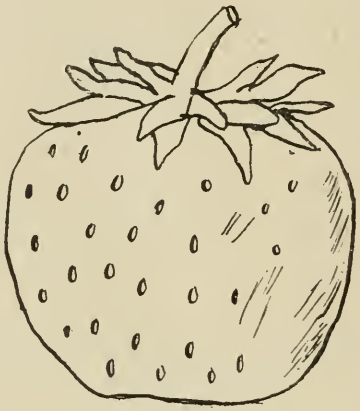
Anna Forrest. Foliage, large and healthy. The fruit is large, somewhat irregular; sweet and pleasant. It is a free runner; only moderately productive. The fruit colors up something like Sharpless. Altogether, with us it is now a promising variety, and we have decided to discard it. So many better ones.

Dayton (S). Originated in Ohio. This is a strong healthy grower, making many runners; plant very healthy. The fruit is large, light in color, not very firm and only moderately productive. We have planted it two seasons, in doubt about it, but have decided to discard it; there are so many better that we have no doubt about.

Princess (P). Originated in Minnesota. This is a good strong grower; plant very healthy and making plenty of runners. The fruit is large in size, good shape, fine to look at, rather soft, not very productive. We are giving it a further trial. There are some parts where it seems to produce large crops of the finest berries.

Grenville (P). Originated in Ohio. Here we have another grand berry, about which there is no doubt at all in anyone's mind, but all pronounce it at once of the first class. We place it alongside Bubach, if not in front. It very much resembles Bubach in color of plant, but it is a free grower, making many more plants; it is more productive. The fruit is not quite so large; about the same in firmness. It certainly is one of the best for the home grower or near market. No one can go wrong in planting largely of the Grenville.

MARSHALL.



MAPLE BANK.

LEADER (S).

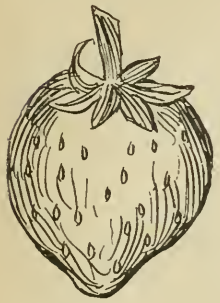
Marshall (S). Originated in Massachusetts. The plant of the Marshall is very large, stools somewhat before sending out runners; rusts somewhat, plant though is vigorous. The fruit is large dark-red, good shape and fine quality; productive. One of the best to grow for show berries. Have fruited it only one season. Will be better able to decide its merits after further trial.

Maple Bank (P). Originated in Ontario. A strong healthy grower, good runner, making wide matted row. The fruit is large, rich, dark crimson and very firm. The shape is good. It is one of the finest and thus should be a good shipper. If it grows to be as good in other places as with us it will take a first place. It is being tested at several places north, south, east and west before being offered to the public.

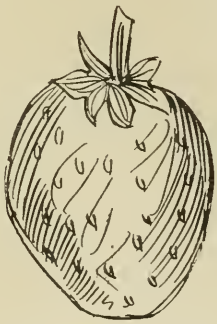
Leader (S). This berry comes from Massachusetts, grown by the late J. C. Campbell. It has done no better here than last year; not a very vigorous grower; some rust; the season is medium; the size this year only medium owing no doubt to the dry weather; quality the very best, and first in firmness; medium in productiveness; it has been very much injured by the frost the past two seasons in blooming time. I shall give it another trial, for I hear many good reports of the Leader. Second year of fruiting.

Saunders (S). This is a Canadian berry, a seedling by Mr. Little, of Ontario. It is a very vigorous grower, makes a wide matted row; it rusts some if allowed to grow too thickly; it is a late bloomer and so often escapes the frost, but it is medium in fruiting; the size of the berry is large; the quality of the fruit is first-class and a firm berry; will carry to distant points and very productive; not as well known as the Williams but

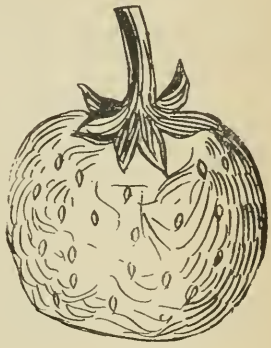
altogether a better sort in every respect; it is rich in pollen and so a good one to plant with pistillate kinds. It is a beautiful shape and fine color, coloring all over at same time; it is a grand and beautiful berry. Fifth year of fruiting.



SAUNDERS (S).



TENNESSEE PROLIFIC (S).

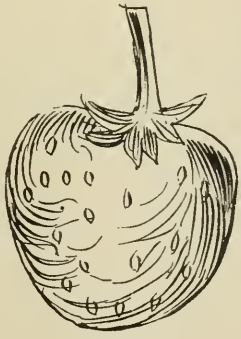


MARY (P).

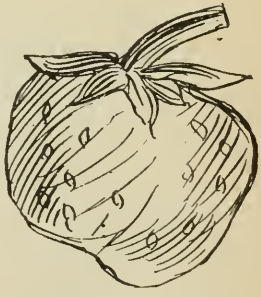
Tennessee Prolific (S.) This is a seedling of the Crescent and Sharpless, it follows the Crescent in productiveness and the Sharpless in size. The plant is a vigorous, healthy grower, making a fine stand of plants. The season of fruit is early medium; size, large; quality, good; and medium in firmness and very productive. The reports are all good of the Tennessee Prolific, no variety has so soon become popular over such a wide extent. To keep up with the procession of the best varieties a grower must have the Tennessee Prolific. It is a grand staminate. Third year of fruiting.

Mary (P.) A seedling of Windsor Chief from New Jersey. The plant is a strong, vigorous grower and quite healthy, the season of fruiting is medium to late, this was one of the least injured by the severe frost last spring at blooming time. The size is of the largest; the quality fair and firm; is very productive, one of the most productive on the place this year, which would indicate it can stand the dry weather as well as severe frost. The color is dark red. I consider it a very hardy variety. It is among the largest of the varieties now before the public. First year of fruiting.

ENHANCE (S).



BISEL (P).



BRANDY WINE (S).

Enhance (S.) A seedling of Windsor Chief and Sharpless from Ohio by H. Young. A strong, vigorous grower and healthy; season of fruit medium, size, large, sometimes irregular. Dark red in color. Quality fair, somewhat sour. One of the firmest and quite productive; one of the richest in pollen, and so one of the best to plant with pistillates. It is a market berry, rather than a table variety. Pistillates planted with the Enhance always bear a good crop of well fertilized, fine shaped berries. Fourth year of fruiting.

Bisel (P.) A seedling of the Wilson from Illinois, by D. L. Bisel. It resembles the Wilson, but is larger. A very vigorous grower, making a wide, matted row; has some rust. Season of fruit, medium to late. Quality, good. Medium in firmness and very productive. A variety well worth trying by growers for market. It is being very largely planted in Illinois, and is said to be in great demand in the Chicago market. First year of fruiting.

Brandywine (S.) Thought to be a cross of Glendale and Cumberland, from Pennsylvania. A strong, vigorous grower, making a fine row; quite healthy. Season of fruit, medium to quite late. Size of fruit, large; quality, good, and firmness, medium; color, dark scarlet. It is well spoken of. It seems from the reports of it to succeed on any soil. It did well here the past season. First year of fruiting.

Longfield P. A seedling of Warfield from Kansas by Dr. Stayman. A vigorous grower like its parent. Very healthy foliage, makes lots of runners; season of fruiting, medium to late; size of fruit, medium to large, regular shape, no misshaped berries; is of good quality and very productive; a rich dark color; above medium in firmness; fruit, long and pointed; should think it would carry well, there are few blanks. Three years of fruiting.

"Stevenson's Seedlings."

Longfield (P).

Stevenson Seedling (No. 7).

Stevenson's (59).

I enclose you outlines of three seedlings of my own, they are promising I only had one plant of each one year from seed, but they are sending out many runners. So I have quite a lot of each for further testing, they are as follows:—

Stevenson's (Della K).

Aroma (S).

Timberrell (P).

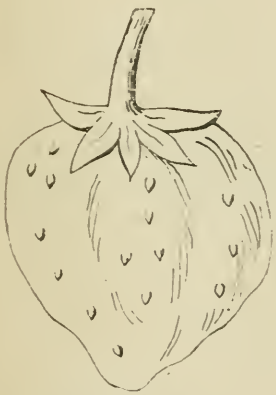
No. 7. Good healthy vigorous grower; season, medium; size, large; quality, good; quite firm, and above medium in productiveness; color, red, flesh red all through.

No. 59. Fine healthy grower; season, early to medium; size, large; quality, good and firm; productiveness, good. This is a seedling of Howard's No. 41 crossed with Howard's No. 25, both these Howard seedlings all from Haverland crossed with Belmont.

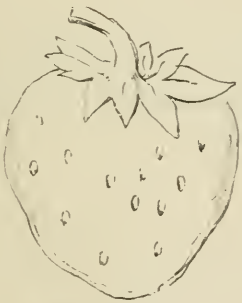
Della K. This is a seedling of Sharpless by Mr. Stevenson of Ontario. Good strong grower; season, early to medium; size, large; quality, good and firm; productiveness, very good. This is a very promising variety, it is as large as its parent the Sharpless, it colors up better than the Sharpless and very much more productive.

Aroma (S.) A seedling of Cumberland from Kansas by E. W. Cruse. A good vigorous grower; no rust; season of fruit, late; size of berry, large; fine quality; quite firm, very good color, a good looking berry and fairly productive, keeps its size well to the last picking; a good pollenizer for large, late pistillates. It seems to do well in all soils and climates, good reports come from all quarters of the Aroma, the plant is strong and very healthy. Third year of fruiting.

Timbrell (P.) A chance seedling from New York by H. S. Timbrell. The plant is a clean, healthy, vigorous grower, no rust whatever, so far. The season of fruiting is late to very late; I picked Timbrell on July 24th, 1895, fine beautiful berries. The size is medium to large; the quality is of the very best and quite firm, will carry well to market and is very productive. The only thing any one could have against the Timbrell here is its color; it is mottled, red, pink and white, but the fine flavor of the berry makes up for the color. It is a fine berry, seems to stand the frost well. Second year of fruiting.

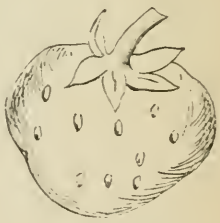


WOOLVERTON (S).



MUSKINGUM (S).

PARKER EARLE (S).



EQUINOX (S).

Woolverton (S.) A seedling by Mr. Little of Ontario. The plant is large, strong and healthy, stands the hot, dry weather with the best, the season of fruit is late; size of berry, one of the largest; quality, fair; color, dark crimson, it is firm for so large a berry, and productive. Although the berry is among the late ones in ripening, it is one of the first to bloom, it is rich in pollen and so one of the very best to plant with the large pistillates; the flesh is white. It is one of the best among the staminates. Fourth year of fruiting.

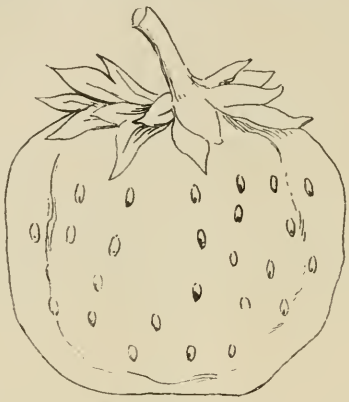
Muskingum (S.) A seedling from Ohio by G. Kearns The plant is a good healthy grower, the season of fruit is late; size of berry, medium to large; quality is good; it is firm and medium in productiveness, it is a very fair variety, it did not do as well this year as in 1894 the frost hurt it very much this year. Second year of fruiting.

Parker Earle (S) A seedling from Texas, from the Crescent crossed with Munson's No. eight, by J. Nimond. The plant makes very few runners, rusts somewhat, the plant stools out; the season is late; the size of berry is small to medium; the quality is fair, and the berry is firm; it is very productive, the plant is not able to mature the great mass of fruit it sets, if it were in a deep rich and moist soil it might do so, but in the soil here it is not worth growing. I have seen the berries just dry up before coloring

then in such hot, dry weather the berries are small and sour, unless under above conditions of soil I would not advise any one to plant largely of Parker Earle. Fourth year of fruiting.

Equinox (S.) A seedling of Mount Vernon, by M. T. Thompson, Va. The plant is a good strong grower, healthy, little or no rust; season of fruiting, very late; size of berry, medium to large; quality, good; color, crimson; the berry is quite firm, and the plant is very productive, in fact one of the most productive I had. I expect to hear very good accounts of the Equinox in the future. First year of fruiting.

GANDY (S).

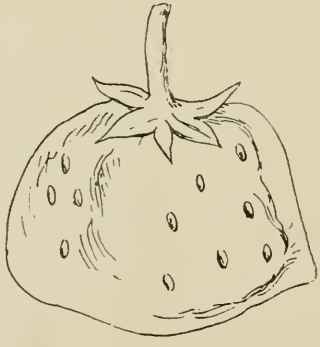


MAPLE BANK (P).

JERSEY QUEEN (P).

Gandy (S) A seedling of Jersey Queen and Glendale. The plant is strong and vigorous grower, quite healthy; season of fruit is late; size of berry, medium to large; quality of fruit is good; a good looking and shapely berry; color, dark crimson; roundish conical, a very firm berry but a shy bearer, this is its great fault, it gives one grand picking then is done. Third year of fruiting.

BELLE (S).



SOME SHAPES OF THE BELLE.

Jersey Queen (P.) The plant is very healthy, a fair grower, of beautiful green foliage, very often as fresh and green after fruiting as before. The season of fruit is very late, has been the standard late berry for some years; size of fruit, large to very large of fine glossy appearance that brings the highest price in the market; it makes a better growth of plants the second year than the first. The berry is firm, and good quality; medium in productiveness. I consider it valuable, as it extends the fruiting season ometimes a week or more. Sixth year of fruiting.

Maple Bank (P.) A seedling by Wm. Stevenson, of Guelph, Ont., thought to be a cross of Crescent and Wilson. The plant is a strong, vigorous grower, making wide matted row. Season medium to late; size of berry, large; quality, best; very firm and productive. Third year of fruiting.

Belle or Crawford's, 51 (P.) A seedling of unknown parentage, by M. T. Thompson, of Virginia. The plant is a strong grower, and healthy. Season of fruit very late, none ripe on 4th July when other kinds were almost over fruiting. Size of berry, large, long, and often irregular; some fan shaped; quality of fruit is good, and berry is firm, and plant quite productive. Second year of fruiting.

The above have done the best this year; but there are other varieties, that under other conditions would be quite as profitable as many of the above. This has been a very exceptional year in strawberry growing, from two causes: first, the week of hard frost in blooming time, and then the very hot and dry season when the fruit was maturing. So it would be hardly fair to take the results of this year as a criterion of what the various varieties are able to do. Some of the kinds that in an average year are among the best, this year were caught at a most critical time in their blooming and did not recover. Some of the kinds sent up a full second set of fruit stalks, notably among these was the Clyde. I think this is the coming variety for Ontario as a market berry.

I have the report of thirty strawberry experts as to the five best sorts for market purposes. These men are scattered over the United States and Canada. Twenty of them named Bubach, fifteen of them named Warfield, thirteen named Haverland, eleven named Lovett. ten Parker Earle, nine Crescent, seven Greenville, six Timbrell, four Gandy, three Van Deman, three Saunders, these seeming to be the most popular sorts that have been generally disseminated. Therefore, one commencing to grow for market could not go far wrong if he planted the five which received the most votes, viz., Bubach, Warfield, Haverland, Lovett and Parker Earle.

I should place Woolverton and Saunders before Lovett, and Greenville in place of Parker Earle, and I should put Clyde among the first three, but of course Clyde was not grown by any of the thirty voting on the five best market sorts, as it is only offered for sale for the first time this fall, although I have fruited it for three seasons.

Some growers make little or no distinction between the kinds intended for market and those for the table. I think this distinction should be made, because it is very seldom that the finest flavored varieties will produce the most boxes or get to market in the best condition.

The variety that is best for the table may be of poor color (*i.e.*, Timbrell) and a light yielder (*i.e.*, Gillespie) or poor in firmness.

The majority of those who buy in the market want size first of all, then color and freshness of look, and are not at all particular as to the flavor or quality, perhaps never tasting a single berry, but buying by the eye alone, while for some people looks go for very little and they want quality alone. Quite a number of varieties that stand high in quality of fruit, and are the very best for the table, cannot be got to market in good shape and so should not be marked high as a market variety except it may be for a very near market.

It may be of benefit to those who have not grown any great number of the later varieties to give a list pointing out the different points in which they excel, as follows:

Early Sorts: Van Deman, Margaret, Michel's Early, Rio, Stone's Early, Beder Wood, Clyde, Cyclone, Haverland, Crescent, Meek's Early, Dayton.

Mid-Season: Bubach, Warfield, Greenville, Leader, Saunder's, Tennessee Prolific, Mary, Enhance, Bisel, Brandywine, Lovett, Williams, Longfield.

Late: Aroma, Timbrell, Woolverton, Muskingum, Gandy, Parker Earle, Equinox, Jersey Queen, Maple Bank, Belle, and others.

Quality: Iowa Beauty, Brunette, Leader, Van Deman, Banquet, Timbrell, Jessie, Gillespie, Auburn, Saunders.

Size Large: Aroma, Bubach, Brandywine, Belle, Briggs, Clyde, Dew, Enhance Greenville, Saunders, Maple Bank, Haverland, Edith (largest), Gandy, Wm. Belt, Mary

Howard's No. 41, Jucunda Improved, Woolverton, Jessie, Jersey Queen, Muskingum, Marshall, Ohio Centennial, Van Deman, Timbrell, Eureka, Hunt's No. 3.

Market Sorts: Clyde, Saunders, Bubach, Haverland, Greenville, Van Deman, Warfield, Aroma, Brandywine, Longfield, Cyclone, Robinson, Tennessee Prolific, Lovett, Mary, Beder Wood, Enhance, Williams.

There are other varieties that have good qualities worthy of trial. Some that have not been fully tested as yet and so are not placed in the lists of the varieties that after full trial have secured recognition over a wide extent.

Below is a list of kinds having many good points, some of them not fully tested:

Phillips, Beverley, Magnate, Barton's Eclipse, Afton, Gertrude, Howard's No 25, Hiawatha, Jurabolo, Kansas Prolific, Princess, Smith's, Sunnyside, Scarlet Ball, Springdale, Huntsman, Splendid, Thompson's No. 40, Gandy Bell, Vera, Plow City, Beauty, Richmond, Hutch Experiment Station 24, Effie May, Charlie, Ivanhoe, Epping, Judsonia, Oberholtzer, America, Snowball.

The following are of little merit and I have decided they are not worth growing:

Anna Forrest, Auburn, Dayton, Dew, Edward's Favorite, Eureka, Farnsworth, Gillespie, Accomac, Bessie, Stevens, Westbrook, Alabama, Clark's E. Middlefield, Mrs. Cleveland, Prize, Martha, Crimson Cluster, Beebe, Parker Earle, Price, Lady Rusk, Swindle, Regina, E. P. Roe, Idaho, Parnell, Standard, Belle of Lacrosse, Primate, Gen. Putnam, Alpine, Hull's No. 6., Hull's No. 8, Jessie, Kossuth, Stone's No. 7, and No. 16, also No. 15, Shuster's Gem.

I have the following new varieties to fruit in 1896 for the first time:

Varieties.	Sex.	Varieties.	Sex.	Varieties.	Sex.
Apache	S	Gardner	S	Reihl's No. 5	P
Aug Nicaise	S	Glen Mary	P	Shawull	S P
Allen		Giant	S	Sharpless Improved	S
Allen's No. 6	P	Hersey	S	Sunrise	P
Allen's No. 13	P	Homestead		Triomphe de Gand	S
Avery's Seedling	P	Hull's No. 3	S	Tubbs	
Black Prince	S	H. W. Beecher	S	Thompson's No. 40	P
Belrin	P	Howard's 501	S	Thompson's 104	
British Queen	S	Howard's 23	P	Victor Hugo	S
Beede's No. 2		Holland	P	West Lawn	P
Banquet	S	Knick's	S	Weston	P
Brunette	S	Laxton's No. 1	S	Yahoo	S
Bouncer	S	Lady Thompson	S	Zulu	S
Cardinal	S	Leviathan	S	Huntsman	S P
Columbia	S	Lady Franklin	P	Buster	S
Champion of England	S	Lord Sheffield	S	Onward	S
Carrie	P	Murray	S	Dora	P
Eleanor	S	Paris King	S	Sargeant	S
Enormous	P	Pet	S	Howard's No. 6	P
Erie	S	Pine Hill No. 20	P	Hunn	P
Fountain	S	Roser	S		
Gunton Park	S	Reihl's No. 6	S		

My report would be incomplete without mentioning the seedlings in the trial plots. One plot is Howard's No. 41, crossed with Marshall and Brandywine. Another plot is Timbrell, crossed with Brandywine and Marshall. Another plot is Marshall seedlings. I have another plot, Howard's No, 41, crossed with Howard's No. 25 and other seedlings; both these seedlings are from Haverland, crossed with Belmont. Amongst the above seedlings are some very fine, strong, healthy plants, giving promise for the future; very vigorous. The size of the fruit is often indicated by the size of the leaf. If this holds good I shall have some large ones among them. Hoping that we may have a more favorable season for strawberries in 1896 I will close.

E. B. Stevenson,
Freeman.

BURLINGTON STATION.—A. W. PEART, FREEMAN, EXPERIMENTER.

Notes on Varieties of Fruits Tested Previous to 1895.

Apples.

American Golden Russet. The trees are healthy, hardy and vigorous, but not very productive.

Baldwin One of our most popular varieties. Tree healthy, medium vigor, hardy enough for all practical purposes, and very productive.

Cranberry Pippin. Tree healthy, very vigorous and hardy. Comes into bearing late, but when it commences is productive and a good shipper.

Early Harvest. Tree healthy, vigorous and productive, but fruit somewhat subject to scab. This year, however, it was clean and of fine quality.

Esopus Spitzenburg. Tree medium vigor, medium hardiness, and not sufficiently productive to be profitable.

Fameuse. Vigorous, hardy and productive, but of late years liable to spot.

Greening. Tree vigorous, hardy and very productive. One of our most profitable.

Holland Pippin. Tree healthy, hardy, vigorous, and fairly productive, but no longer profitable on account of the spot.

King. Tree healthy, hardy and vigorous. Requires age to be productive. Should have a place in a commercial list for planting on account of its great value for dessert, cooking and market purposes.

Northern Spy. Tree healthy, hardy and vigorous. Late in bearing, but then productive. The fruit of late years has been somewhat affected with the spot.

Ribston Pippin. Tree medium vigor, healthy, hardy and very productive. Our best and most profitable fall apple.

Red Astrachan. Tree vigorous, hardy and productive. The fruit some seasons is injured by the spot.

Roxbury Russet. Tree vigorous, hardy and medium productive. The fruit cannot rank with the Baldwin or Greening for profit.

I have also the following varieties of apples, which have scarcely reached bearing age: Duchess of Oldenburg, Gravenstein, Hawthornden, Longfield, Pewaukee, St. Lawrence, Tolman Sweet, Wagener and Wealthy.

Pears.

Anjou. Tree vigorous, healthy, hardy and fairly productive. Fruit large and excellent, but drops from the trees too easily. A most valuable variety for market. Season, November to January.

Belle Lucrative. Tree medium vigor, hardy and moderately productive. Fruit medium and of fine quality. Season, September.

Bartlett. The most extensively grown of any variety in this district. Tree medium vigour and hardiness, and very productive. Fruit large and most excellent. Season, early September.

Clapp's Favorite. Tree very vigorous, hardy and productive. Fruit large, quality fine. Season, late August.

Duchess D'Angouleme. As a dwarf this pear has of late years been very extensively planted Tree very vigorous, hardy and productive. Fruit large and excellent. Season, October to November.

Flemish Beauty. Tree vigorous, hardy and productive; but of late years the fruit has been almost unsalable through the ravages of the scab. Season, September.

I have also the Duchess, as a standard; the Kieffer, a rank, vigorous grower, and the Sheldon; but the trees are young, and have had but little fruit on as yet.

Plums.

Bradshaw. Tree vigorous, healthy and hardy, but only moderately productive. An upright grower. Fruit large, reddish purple. One of our earliest plums, and commands a high price. Season, August.

Lombard. Probably our most profitable plum. Tree spreading and a vigorous grower when young; hardy and very productive. Fruit medium, violet red. Season, early September.

Native Blue. Fifteen or twenty years ago, quite extensively grown, but they were swept away by the black knot. Tree vigorous, hardy and productive. Fruit medium, dark blue. Season, September.

Reine Claude. A new and very promising plum in this district. Tree vigorous, hardy and productive. Fruit medium, roundish, greenish-yellow, rich and sweet. Season, September to October.

Seedling No. 1. Known here as *Ireland's* Seedling. Tree a moderate grower, hardy and productive. Fruit medium to large, roundish-oval, reddish-purple with a rich bloom. One of our best plums for dessert, cooking and market. A very small and free stone. Season, August.

Seedling No, 2. Tree vigorous, hardy and productive. Fruit medium, long-oval, bluish-purple. A good cooking and market plum. Season, early September.

Seedling No. 3. Tree a moderate grower, hardy and moderately productive. Fruit medium, oval, yellow. Season, Early September,

In addition, I have these varieties, planted in 1892—they have grown well, but have not as yet fruited much:—Abundance, Coe's Golden Drop, General Hand, German Prune Glass' Seedling, Gueii, Imperial Gage, Italian Prune, Marianna, Monroe Egg Niagara, Ogan, Prunus Pissardi, Prunus Simonii, Purple Egg (Hudson River), Purple Egg, Shipper's Pride, Smith's Orleans, Staunton, Washington, Yellow Egg, Yellow Gage.

Grapes.

Agawam (Roger 15). Vine, a vigorous grower, but not very productive, and liable to mildew. Bunch, medium to large. Berry, red, large, thick skin. Season, September.

Brighton. Vine, vigorous and productive, but somewhat subject to mildew. Bunch, large and shouldered. Berry, purplish-red, medium, and excellent in quality. Season, September.

Champion. Vine, very vigorous, hardy and productive. Bunch, medium to large. Berry, medium, black, and of poor quality. Season, August.

Concord. The most generally grown here of any variety, and probably our most profitable grape. Vine, vigorous, hardy, healthy, and very productive. Bunch, large. Berry, medium to large, black. Season, September.

Delaware. Vine, short-jointed, light, but healthy grower, hardy and an abundant bearer, but unprofitable commercially. "They don't fill up." Bunch, small. Berry, small, red. Season, September.

El Dorado. A new grape here, and not very promising. Vine, moderately vigorous, and only fairly productive. Bunch, medium. Berry, medium, white. Season, September.

Eaton. A new black grape here. Vine, vigorous and healthy, but, as yet, (three years old,) unproductive.

Jessica. Vine, a moderate grower, healthy, hardy and productive, but, like the Delaware, unprofitable. Bunch, small. Berry, small, white, quality fine. Season, September.

Lady. Vine, medium vigor, hardy and only fairly productive. Bunch, medium. Berry, medium, white. Season, early September.

Lindley (Roger 9). One of our best red grapes. Vine, vigorous, hardy and productive. Bunch, large. Berry, medium to large, quality excellent. None better for market as well as dessert. Season, early September.

Moore's Diamond. A new and most promising white grape. Vine, vigorous, hardy and very productive. Bunch, large, shouldered. Berry, large. Season, early September.

Moore's Early. Vine, light grower, hardy and only moderately productive. Bunch, medium. Berry, large, black. Season, August and early September.

Moyer. Vine, a matty, short-jointed, healthy grower, hardy and productive. Bunch, small. Berry, small, red. Very early. Season, August.

Niagara. Vine, very vigorous and productive, but somewhat tender, and should have winter protection. Bunch, large. Berry, large, quality only fair. Season, September.

Vergennes. A promising red grape for this locality. Vine, vigorous, hardy and very productive. Bunch, large. Berry, large. Season, September and October.

Wilder (Roger 4). Vine, vigorous, somewhat tender, and moderately productive. Bunch, large. Berry, large. Season, September.

Worden. One of our most profitable black grapes. Vine, vigorous, hardy and very productive. Bunch, large. Berry large, quality excellent. Season, early September.

Wyoming Red. This red grape promises to be valuable for market purposes. Vine, a fair grower, hardy, healthy and very productive. Bunch, small to medium. Berry, medium, quality only fair. Season, August and September, same as Moore's Early.

Raspberries.

Brandywine. Cane, stocky, hardy and productive. Berry, medium to large, red, firm, quality rather inferior.

Cuthbert. Cane, vigorous, hardy, and very productive. An upright grower. Berry, large, bright red, firm, of good quality. Season, medium to late.

Highland Hardy. Cane, healthy, hardy and fairly productive. Berry, small to medium, red, quality inferior. Season, early.

Marlboro'. Cane, healthy, hardy and productive. Berry, large, firm, red, and only fair in quality. A valuable variety here for market. Season, early.

Turner. Cane, healthy, hardy and productive. Berry, red, medium, soft, quality excellent. Season, medium.

Blackberries.

Snyder. Cane, healthy, hardy, and very productive. Berry, medium, firm, quality good. Season, medium.

Lawton. Cane, a strong grower, and very productive, but requires winter protection here. Berry, large, somewhat soft, quality excellent.

I also planted for testing, during the spring of 1895, the following varieties. The soil is a rich gravelly loam, underdrained, damp, but not wet:

Raspberries. All Summer, Columbia, Eureka, Hilborn, Golden Queen, Kansas, Palmer, Progress, Reliance, Shaffer's Colossal, Thompson's Early.

Blackberries. Agawam, Child's Tree, Early Cluster, Early Harvest, Erie, Ganior, Kittatinny, Lovett's Best, Maxwell, Ohmer, Stone's Hardy, Taylor's Prolific, Western Triumph, Wachusetts.

Of these varieties, Columbia and Shaffer's Colossal have made a very vigorous growth Kansas and Hilborn also a strong growth, while the other varieties have made a growth from medium to strong. All are in a healthy condition, notwithstanding the drouth and extremes of temperature.

In addition to the above I received a few other varieties for planting, but owing to their late arrival and other unfavorable conditions, they entirely failed to grow.

Currants.

In the spring of 1895 I planted one thousand currant bushes, consisting of the following varieties: Cherry, Fay's Prolific Versailles, Raby Castle, Victoria, White Grape, Naples and Champion. They have made a good growth and are thrifty and healthy.

CATALOGUE OF FRUITS FOR THE USE OF PLANTERS.

APPLES.

Varieties tested.	Season. (Month of use.)	Tree.			Total value of tree.	Fruit.				Total value of fruit.	Total value of variety.
		Vigor, Scale 1-10.	Hardiness, Scale 1-10.	Productiveness, Scale 1-10.		Quality, Scale 1-10.		Value, Scale 1-10.			
						Dessert.	Cooking.	Home market.	Foreign market.		
Bay of Quinte Station.											
Albury	Aug.-Sept	8	10	6	24	6	6	4	.....	16	40
Alexander	Aug.-Oct	10	10	8	28	4	9	9	9	31	59
American Golden Russet	Jan.-May	8	10	6	24	8	8	7	9	32	56
Bailey Sweet	Nov.-Mar	6	8	8	22	4	8	4	4	20	42
Baldwin	Jan-Mar	6	7	8	21	4	6	8	8	26	47
Beauty of Kent	Oct.-Nov	10	10	8	28	4	6	8	8	26	54
Ben Davis	Mar.-May	8	10	10	28	4	6	6	9	25	53
Benoni	July-Sept	8	10	8	26	10	8	4	7	29	55
Blenheim Pippin	Nov.-Mar	10	10	10	30	6	7	9	9	31	61
Bonum	Dec.-Feb	8	10	10	28	8	8	7	7	30	58
Cabashea	Dec.-Feb	10	10	5	25	2	6	6	6	20	45
Canada Red	Dec.-Mar	8	9	10	27	6	8	8	.....	22	49
Duchess	Aug.-Sept	10	10	10	30	6	9	10	9	34	64
Fallawater	Jan.-Mar	10	10	5	25	6	8	8	9	31	56
Fameuse	Sept.-Dec	8	8	10	26	10	8	10	8	36	62
Fall Queen (Haas)	Sept.-Nov	8	8	8	24	5	6	6	6	23	47
Grand Sultan	Aug.-Sept	10	10	8	28	5	8	6	6	25	53
Hastings	Jan.-Feb	8	9	8	25	8	7	7	6	28	53
Hawthornden (new)	Oct.-Dec	8	8	8	24	7	7	8	8	30	54
Hawthorden (old)	Sept.-Nov	7	8	8	23	5	7	5	7	24	47
Highland Beauty	Jan.-Mar	6	9	8	23	9	7	7	7	30	53
Horn	Dec.-Mar	8	10	10	28	8	7	7	7	29	57
Hurlbut	Dec.-Feb	7	9	7	23	8	8	8	8	32	55
Jonathan	Dec.-Mar	8	8	9	25	10	7	8	9	34	59
Lady	Jan.-Mar	7	8	9	24	9	.....	1	2	12	36
La Rue	Oct.-Dec	10	8	6	24	.....	7	7	6	20	48
Lord Burleigh	Jan.-May	10	9	9	28	8	10	8	8	34	62
Lord Suffield	Aug.-Sept	6	8	9	23	4	7	5	5	21	44
Margil	Nov.-Jan	6	7	9	22	10	8	7	7	32	54
Mountain Beet	Sept.-Oct	8	9	8	25	6	6	5	....	17	42
Mountain Tulip	Sept.-Oct	7	8	8	23	6	6	6	.....	18	41
Northern Spy	Jan.-Mar	10	8	10	28	9	9	9	9	36	64
Northfield Beauty	September	8	9	9	26	9	8	9	.....	26	52
Mother	Nov.-Jan	5	7	7	19	10	8	7	7	32	51
Ontario	Jan.-Mar	8	9	10	27	9	9	9	9	36	63
Pomme Grise	Nov.-Jan	7	8	9	24	9	8	5	.....	22	46
Rawle's Janet	Feb.-June	6	9	10	25	5	4	5	5	19	44
Simcoe Station.											
Alexander	Oct.-Dec	10	10	10	30	5	10	10	9	34	64
Astracan, Red	Aug.-Sept	9	10	8	27	8	8	7	1	24	51
Baxter or La Rue	Oct.-Feb	9	10	8	27	4	9	8	8	29	56
Ben Davis	Oct.-June	9	9	10	28	2	4	8	9	23	51
Colvert	Oct.-Jan	9	10	9	28	5	9	9	8	31	59
Duchess	Aug.-Sept	9	9	10	28	6	10	10	8	34	62
Fameuse	Oct.-Jan	8	8	10	26	10	8	9	8	35	61
Fall Queen (Haas)	Oct.-Feb	10	10	10	30	4	7	7	8	26	56
Gideon	Oct.-Dec	10	10	10	30	8	9	10	8	35	65
Grime's Golden	Oct. Mar	7	5	8	20	9	4	6	7	26	46
Hurlbut	Oct.-Mar	8	9	8	25	8	8	8	8	32	57
King of Tompkins	Oct.-Mar	7	5	5	17	9	9	10	10	38	55
Maiden's Blush	Oct.-Dec	9	10	10	29	5	8	9	8	30	59
Mann	Jan.-April	9	10	9	28	8	9	9	10	36	64
Northern Spy	Oct. May	9	7	9	25	10	10	10	10	40	65
Pewaukee	Oct -Mar	10	10	8	28	6	8	9	9	34	62
R. I. Greening	Oct.-May	8	5	10	23	8	10	8	9	35	58

CATALOGUE OF FRUITS.—*Continued.*

APPLES.—*Concluded.*

Varieties tested.	Season. (Month of use.)	Tree.			Total value of tree.	Fruit.				Total value of fruit.	Total value of variety.
		Vigor, Scale 1-10.	Hardiness, Scale 1-10.	Productiveness, Scale 1-10.		Quality, Scale 1-10.		Value, Scale 1-10.			
						Dessert.	Cooking.	Home market.	Foreign market.		
SIMCOE STATION.—*Concluded.*											
St. Lawrence	Oct.-Nov	9	10	10	29	10	9	9	5	33	62
Ribston Pippin	Oct.-Feb	8	8	8	24	10	8	10	10	38	62
Tolman Sweet	Oct.-Mar	10	10	9	29	6	5	2	5	18	47
Tetofsky	August	9	10	9	28	7	9	6		22	40
Twenty Ounce	Oct.-Jan	9	9	8	26	4	7	8	9	29	55
Wealthy	Sept.-Dec	9	10	10	29	8	8	9	8	33	62
Wagener	Oct.-Mar	8	9	8	25	7	8	8	7	30	55
Yellow Transparent	August	10	10	8	28	6	8	6		20	48

PEARS.

BAY OF QUINTE STATION.											
Annanas d'Ete	Aug.-Sept	8	6	4	18	4	4	5		13	31
Bartlett	September	8	6	9	23	9	9	10		28	51
Belle Lucrative	Sept-Oct	8	8	8	24	8	8	8		24	48
Beurre Clairgeau	Nov.-Dec	8	6	8	22	4	6	8		18	40
Beurre d'Anjou	Nov.-Jan	10	10	6	26	8	8	10		26	52
Beurre Gris d'Hiver	March	10	10	8	28	4	4	4		12	40
Beurre Hardy	Sept-Oct	10	10	10	30	8	8	9		25	55
Buffum	October	10	10	10	30	4	4	4		12	42
Boussock	Sept.-Oct	10	10	10	30	8	9	9		26	56
Clapp's Favorite	Aug.-Sept	10	8	10	28	8	8	9		25	53
General Todleben	Nov.-Dec	8	9	8	25	10	8	8		26	51
Josephine de Malines	Dec.-Mar	8	9	9	26	10	8	8		26	52
Lawrence	Dec.-Jan	8	10	10	28	8		8		16	44
Louise Bonne	Sept-Oct	7	8	9	24	6		8		14	38
Mount Vernon	Oct.-Nov	9	10	10	29	6		5		13	42
Onondaga	Sept.-Nov	9	10	10	29	5		7		12	41
Sheldon	October					10		9		19	

CATALOGUE OF FRUITS.—*Continued.*

GRAPES.

Varieties tested.	Season.	Vine.					Value 1-10.				Remarks.
		Vigor, Scale 1-10.	Hardiness, Scale 1-10.	Productiveness, Scale 1-10.	Freedom from disease, Scale 1-10.	Total Value of Vine.	Dessert.	Market.	Total value of fruit.	Total value of variety.	
WENTWORTH STATION.											
Adirondac	Sept	3	2	2	2	9	9	2	11	20	One of the best, very weak, needs protection.
Alvey (Hagar)	Oct	7	8	6	8	29	2	2	4	33	Of little value.
Agawam (Roger 15)	Oct. & Nov.	9	9	8	4	30	9	9	18	48	Most productive on clay loam with hard subsoil. Needs long pruning.
Amber	Oct	6	6	3	4	19	2	2	4	23	Too late; does not mature.
Amber Queen	Oct. & Nov.	7	6	5	6	24	6	5	11	35	A long keeper.
August Giant	Sept	8	8	7	8	31	5	5	10	41	Too tender to ship.
Barry (Roger 43)	Oct	9	9	8	7	33	7	7	14	57	One of the best black Roger's.
Black Pearl	Sept	9	9	9	9	36	2	2	4	40	
Brighton	Sept	8	10	7	6	33	8	7	15	48	
Catawba	Oct. & Nov.	8	10	8	5	31	10	10	20	51	Will ripen in favorable localities.
Cottage	Sept	6	8	3	8	25	4	4	8	33	Crops from the stem.
Creveling	Sept	10	10	6	6	32	6	4	10	42	
Diana	Oct	9	9	7	6	31	6	6	12	43	
Dracut Amber	Sept	6	9	7	6	28	2	4	6	34	
Duchess	Oct	6	5	6	8	25	5	6	11	36	A choice winter grape.
Eldorado	Sept	8	8	6	7	29	9	6	15	44	Very fine for amateurs.
Empire State	Sept	7	8	4	7	26	4	4	8	34	
Eumelan	Sept	6	7	6	7	26	7	5	12	38	
Goethe (Roger No. 1)	Oct	9	9	8	8	34	4	7	16	50	
Jefferson	Oct. & Nov.	4	5	5	7	21	6	6	12	33	Ripens too late.
Lady	Sept	2	10	2	6	20	8	8	16	36	Not productive.
Lady Washington	Oct	9	9	7	5	30	4	4	8	38	Requires a longer season than ours.
Lindley (Roger's 9)	Sept	9	10	8	8	35	9	9	18	53	
Marion	Oct	9	9	7	7	32	2	2	4	36	
Martha	Sept	4	6	4	6	20	7	4	11	31	An amateur grape.
Massasoit (Roger 3)	Sept	10	9	6	6	31	8	7	15	46	Should be grown with other varieties to fertilize it.
Missouri Riesling	Oct	7	8	7	5	27	4	3	7	34	A wine grape.
Moore's Early	Sept	5	9	4	9	27	7	8	15	42	Not productive enough.
Moore's Diamond	Sept	6	8	6	7	27	7	7	14	41	
Noah	Oct	9	9	10	5	33	2	3	5	38	Too poor in quality.
Perkins	Sept	8	8	7	7	30	3	5	8	38	
Prentiss	Oct	6	7	6	6	25	5	5	10	35	Overloads and does not ripen its wood.
Rebecca	Sept	3	4	3	3	13	8	5	13	26	An amateur grape.
Requa (Roger 28)	Sept	10	8	8	7	33	8	8	16	49	One of the best Roger's.
Salem	Sept	10	8	8	6	32	8	9	17	49	
Taylor	Oct	9	9	3	7	28	2	2	4	32	Of no value.
Vergennes	Oct. & Nov.	7	7	6	7	27	6	8	14	41	
Wilder	Sept	7	9	7	7	30	7	8	15	45	
Worden	Sept	7	10	7	8	32	9	8	17	49	
Wyoming Red	Sept	8	8	7	8	31	4	6	10	41	Very handsome, but too poor in quality.

CATALOGUE OF FRUITS.—*Continued.*

STRAWBERRIES.

Tested by E. B. Stevenson, of Lowville, Ont., in 1894, and Previous Years.

Variety.	Sex.	Season.	Plant. Value, scale 1-10.			Fruit. Value, scale 1-10.			Total value of variety.
			Vigor.	Productiveness.	Total value of plant.	Dessert.	Market.	Total value of fruit.	
Aroma	B	L	8	8	16	8	9	17	34
Auburn	P	M	9	7	16	10	7	17	34
Barton's Eclipse	P	M	8	7	15	7	7	14	29
Beder Wood	B	E	6	8	14	6	8	14	28
Beverley	B	M L	7	8	15	8	9	17	32
Boynton	P	E M	9	9	18	6	4	10	28
Bubach 5	P	M	7	9	16	8	10	18	34
Chairs	P	E M	7	6	13	8	6	14	27
Clyde	B	E	9	9	18	9	9	18	36
Cyclone	B	E	9	9	18	8	8	16	34
Dayton	B	M	9	6	15	7	8	15	30
Dew	B	L	5	4	9	7	6	11	20
Edgar Queen	P	M L	8	5	13	7	4	13	26
Enhance	B	M	9	8	17	6	10	16	33
E. P. Roe	B	M L	5	6	11	6	5	11	22
Eureka	P	L	8	5	13	6	5	11	24
Gandy	B	L	8	6	14	8	6	14	28
General Putman	P	E M	8	5	13	5	4	9	22
Gillespie	B	M	8	7	15	10	7	17	32
Governor Hoard	B	M L	8	7	15	9	7	16	31
Greenville	P	M	4	10	14	8	10	18	32
Haverland	P	E	9	10	19	8	10	18	37
Iowa Beauty	B	M	8	7	15	10	7	17	32
Leader	B	E	5	5	10	10	6	16	26
Longfield	P	M L	9	9	18	8	9	17	35
Lovett	B	M	9	7	16	6	8	14	30
Maple Bank	P	M L	9	8	17	9	8	17	34
Marshall	B	M	8	6	14	8	7	15	29
Michel's Early	B	E	10	5	15	6	8	14	29
Mrs. Cleveland	P	M	8	6	14	5	5	10	24
Muskingum	B	M	8	7	15	8	6	14	29
Parker Earle	B	M L	6	9	15	8	8	16	31
Phillips' Seedling	B	M	9	7	16	7	6	13	29
Princeton Chief	P	L	8	5	13	8	8	16	29
Saunders	B	M	9	9	18	9	9	18	36
Swindle	P	M	5	5	10	6	7	16	23
Tennessee Prolific	B	M	10	9	19	8	8	16	25
Timbrell	P	L	7	8	15	9	6	15	30
Van Deman	B	E	10	8	18	9	9	18	36
Warfield	P	E M	10	9	19	8	9	17	36
Williams	B	M	9	8	17	5	8	13	30
Woolverton	B	L	9	8	17	9	8	17	34

CATALOGUE OF FRUITS.—*Continued.*

GOOSEBERRIES.—Tested at Brampton by A. Morton.

Variety.	Season.	Plant. Value, scale 1-10.				Fruit. Value, scale 1-10.			Total value of variety.
		Vigor.	Productiveness.	Freedom from mildew.	Total value of plant.	Dessert.	Market.	Total value of fruit.	
Bloodhound	M	9	9	10	28	9	9	18	46
Champagne	E	9	9	10	28	10	10	20	48
Companion	M	9	9	10	28	10	9	19	47
Coiner	M	9	9	10	28	10	8	18	46
Crown Bob	M	8	9	10	27	9	10	19	46
Duke of Sutherland	M	10	10	10	30	10	10	20	50
Gipsy Queen	M	10	8	10	28	9	9	18	46
Industry	M	10	10	10	30	7	7	14	44
Keepsake	M	9	10	10	29	9	9	18	47
Lancashire Lad	M	9	9	10	28	10	10	20	48
Large Scotch Red	M	10	8	10	28	9	9	18	46
Morden's Golden Drop	M	9	10	10	29	10	10	20	49
Ocean Wave	M	8	9	10	27	10	10	20	47
One-of-them	M	10	9	10	29	10	10	20	49
Pindston Green Gage	M	10	9	10	29	10	10	20	49
Princess Royal	M	8	8	10	26	9	9	18	44
Red Warrington	M	9	9	10	28	10	10	20	48
Ringer	M	8	8	10	26	9	9	18	44
Scotch Jam	M	10	10	10	30	4	10	14	44
Shakespeare	M	7	6	10	23	9	9	18	41
Smolenski	M	8	7	10	25	9	9	18	43
Thumper	M	10	9	10	29	9	9	18	47
Two-to-one	M	10	9	10	29	10	10	20	49
Whitesmith	M	9	8	10	27	10	10	20	47
Wonderful	M	10	10	10	30	10	10	20	50
Yorkshire Lad	M	9	9	10	28	10	10	20	48

APPENDIX.

REPORT OF THE DIRECTOR OF EXPERIMENTAL SPRAYING.

In presenting my report on the spraying experiments conducted during the past season, and covering as they did so wide a range of territory, there must naturally be more or less difference in the climatic conditions causing varying results to follow, as all are aware some parts of the territory experienced a severe frost, and at a time when the fruit-buds were very susceptible to injury, and also when fungous and insect enemies were in their most tender period of development, causing a check to their work of destruction as well as the loss of the fruit crop; and this, in the westerly portion of the province at least, being followed by a prolonged drouth. All these influences combined rendered the work of as little effect as possible, and yet there is sufficient evidence to convince us of the benefits to be derived.

My first work was to carefully look over the territory to be covered by the work, and select those points most largely engaged in fruit culture, and where the largest numbers of people interested might witness the work and results that would follow; selecting also such points as were accessible by rail in order that the experimenters could accomplish their work each day and the whole be repeated at intervals of twelve days until completed.

I then sent notices to a number of prominent fruit growers in each locality, stating I would visit their locality on a certain day, and would be glad to meet as many as could conveniently attend to explain to them the work that was intended to be done, and ask their hearty co-operation in carrying it out. In many places large numbers were present, and a resolution passed expressing their appreciation of the work the Department had undertaken.

The next point was to secure capable experimenters to perform the work, and suitable outfits for the purpose. I then made this proposition to the spray pump manufacturers of Ontario, that they would furnish the various points with a complete outfit free of charge on the understanding that those outfits were suitable to perform the work. They met this proposition in a liberal manner, and I trust mutually advantageous; and, in order to convince me of the efficiency of the work their pumps were capable of doing, they brought them to my orchard, where fifty gallons of the Bordeaux mixture was supplied and applied to the trees in a satisfactory manner.

On the 24th of April the first experimenter, Mr. A. W. Muir, commenced his work at Chatham in the southern division, taking in Windsor, Kingsville, Blenheim, Appin, Aylmer, Simcoe, Jarvis, Marshville and Welland. The second experimenter, Mr. H. H. Farrell, commenced his work at Thedford on the 26th of April, taking in Clinton, Walkerton, Mount Forest, Owen Sound, Meaford, Collingwood, Barrie, Orillia and Newmarket. And the third experimenter, Mr. Judson O. Konkle, started on the 29th of April, at Whitby, then Bowmanville, Cobourg, Belleville, Napanee, Kingston, Gananoque, Brockville, Morrisburg and Cornwall. All continued their rounds with promptness and regularity until six applications were made. The following will give the date of each spraying, the weather on the day of applying, the appearance of the foliage and fruit as noted by the experimenters on the different dates, and my report as to results at the end of the season on personal inspection.

In this report copper sulphate will mean four pounds of copper sulphate to fifty gallons of water. Bordeaux will mean four pounds of copper sulphate and four pounds of fresh lime to fifty gallons of water, and where Paris green is added means four ounces; this is for apple trees.

In the *first* spraying the copper sulphate solution was used at Chatham, Thedford, Clinton, Walkerton, Mount Forest, Owen Sound and Meaford, while the Bordeaux mixture was used at the other places. For the *second* application Bordeaux was used at all places, while, for the *third*, *fourth*, *fifth* and *sixth* spraying a mixture of Bordeaux and Paris green was applied.

WINDSOR—NORTH ESSEX.

1st—April 25th—Fine, clear and warm. Trees rather close together.

2nd—May 6th—Rain from noon until 2.30 p.m ; an hour later spraying was done ; rain again at night. Buds in some varieties about fully opened ; foliage looking well ; fine show of bloom.

3rd—May 20th—Clear, fine but cold. Foliage looking fairly well ; hurt very little with the frost ; bloom all off ; early varieties injured by frost ; later varieties but slightly injured.

4th—June 3rd—Clear and very warm. Foliage looking good ; no sign of spot on leaf or fruit ; a little showing on trees not sprayed.

5th—June 14th—Clear, warm and windy. Foliage good ; the spot showing quite bad on trees not sprayed ; very little, if any, on the sprayed trees.

6th—June 26th—Clear, fine and warm. Foliage looking good ; spot showing bad on trees not sprayed ; very dry and warm.

I inspected the orchard of Mr. Hypolite Malleoux on the 29th of August, in company with Mr. John Craig, Horticulturist Experimental Farm, Mr. Clinton and Mr. McNeill of Windsor. I found the orchard in a good state of cultivation, and lying along the shore of the St. Clair river. The trees were too closely planted for best results ; the sprayed trees showed a more healthy foliage than the unsprayed ; very little fruit, but what there was on the sprayed trees were quite free from scab, larger in size and more perfect in form and color. The early frost had evidently done its work, as you will notice by the experimenter's remarks when making the second application. He says : " Fine show of bloom." The neighboring orchards at the time of my inspection were not showing a healthy foliage. Varieties sprayed : Northern Spy, Snow and Russets.

KINGSVILLE—SOUTH ESSEX.

1st—April 26th—Cool, cloudy and high wind. Very difficult to get the work thoroughly well done on account of the wind.

2nd—May 7th—Showers in the forenoon ; cleared up ; did the spraying in the afternoon. Only a sparse show of bloom in the orchard sprayed ; the bud moth at work on the peach here.

3rd—May 21st—A severe frost : clear and cold the day before ; prospects fair to-morrow. Foliage appears slightly damaged by the frost ; bloom about all off, and injured more or less by the frost.

4th—June 4th—Rain at 6 p.m. Foliage good ; no sign of spot on leaf or fruit ; a little on trees not sprayed ; very little fruit in the orchard.

5th—June 15th—Clear, fine and very warm. Foliage could hardly look better ; farm crops looking well.

6th—June 27th—Clear, fine and very warm. Foliage grand ; no sign of spot on trees sprayed, and very little on those not sprayed.

Inspected Mr. J. D. Wigle's orchard on the 29th of August. Orchard in high state of cultivation and well pruned ; while the foliage on the unsprayed trees were not seriously affected, the sprayed trees presented in a marked degree a rich and healthy color and a fine growth of wood ; the fruit clean and bright and of larger size than on the unsprayed trees of the same variety. Mr. Wigle informed me he had used the Bordeaux on plum trees with very good results. The varieties sprayed in the orchard were Canada Red, Rhode Island Greenings, Russet, Wagener and Baldwin.

BLENHEIM—E. KENT.

1st—April 27th - Cold, cloudy and high wind. A high wind, but succeeded in applying the solution quite evenly.

2nd—May 8th—Clear and fine ; rain the night before. Buds not quite so far advanced, just about right for the second application ; very little show for bloom.

3rd—May 22nd—Clear, fine and very warm, with high wind. Mr. Cameron sprayed the balance of his orchard, not leaving any ; but after the first spraying he left the next row to the sprayed trees ; only a little bloom in this orchard, and that damaged badly by frost.

4th—June 5th—Cloudy and cool; rain this morning. Foliage looking fairly good; no sign of spot on the trees sprayed; a very little on those not sprayed; only a tree or two with fruit; very few insects; peaches were all injured by the frost.

5th—June 17th—Clear and fine, with high wind. Foliage good; very little sign of spot; very little fruit here; they commenced cutting clover to-day.

6th—June 28th—Clear and cooler. Foliage good; no sign of spot on leaf or fruit; very dry here.

Inspected the orchard of Mr. Cameron on the 30th of August and found the foliage on the sprayed trees more healthy than on those not so thoroughly treated; very few apples here. The frost and the drouth had left little to report upon.

Chatham—West Kent.

1st—April 24th—Clear, bright and windy. Buds nearly ready to open. This orchard was sprayed last year.

2nd—May 9th—Clear and warm. Nearly in full bloom and foliage good; only a few of the sprayed trees show any bloom. Trees too close together to spray evenly.

3rd—May 23rd—Clear and warm. Foliage looking fairly well. Bloom all off and the fruit injured by the frost of the 21st inst; two-thirds at least destroyed. Peaches, plums, cherries, grapes and currants all destroyed.

4th—June 6th—Clear and cool. Foliage good; no fruit on sprayed trees nor sign of spot on foliage; an insect here working on the black currant.

5th—June 18th—Clear and very warm. A. H. Pettit present and had a photograph taken of the work in progress. Foliage looking very good.

6th—June 29th—Clear and cool. Foliage good, nor sign of spot on leaf or fruit; very dry here.

I inspected the orchard of Mr. Dolson, Chatham, County Kent, on the 9th of October and found the foliage good throughout his orchard. Mr. Dolson sprayed this orchard last year and once this year When he saw no fruit he discontinued the work. He had a few Northern Spys, Twenty Ounce and Yellow Belle-fleur in another orchard They were more or less ill-shapen and somewhat scabby. The orchard had been top dressed with farmyard manure and the trees well pruned, but had been planted too near together.

Appin—West Middlesex.

1st—April 29th—Clear and warm. A fine day for the work.

2nd—May 10th—Clear, warm and windy. The trees are too close together a good show of bloom.

3rd—May 25th—Clear, warm and high wind. Foliage slightly injured by the frost; at least two-thirds of the fruit destroyed, and plums and cherries nearly a total loss.

4th—June 7th—A slight frost this morning; clear fine and cool. Foliage looking fairly well; quite a few apples on some of the trees.

5th—June 19th—Cloudy, close and hot; a light shower in the morning; like rain again. Foliage good; very little spot on fruit or foliage, but quite a little on the unsprayed trees; crops looking fairly good, but rain badly needed here.

6th—July 4th—Clear and cool. Foliage in good condition; no sign of spot on leaf or fruit, and very little on those not sprayed.

Inspected the orchard of Alexander McDonald, Appin, County of West Middlesex, on 10th of October. Foliage fairly good, crop very light and pretty free from scab. Some damage by the codling moth. This orchard was sprayed last year with Paris green and this year with Bordeaux. Here and there a tree was left in the experimental block, and a slight improvement in foliage and size of fruit was all that could be claimed.

Aylmer—Elgin.

1st—April 30th—Clear, fine and warm. An uneven lot of trees; some quite old. A fine day for the work.

2nd—May 11th—A high wind and showers throughout the day. Buds in bloom; foliage good, rain immediately after the spraying.

3rd—May 27th—Cloudy, cold and high wind. Foliage looking fairly well; all kinds of fruit here damaged by the frost.

4th—June 8th—Clear, fine and very warm. Foliage in good condition; very little fruit on the trees here.

5th—June 20th—Cloudy; a very slight shower. Foliage looking well, the spot showing a little on the unsprayed trees.

6th—July 3rd—Clear, fine and very dry. Foliage good; no sign of spot on the leaf, and very little on the unsprayed trees.

Inspected the orchard of Francis Leeson, Aylmer, County of Elgin, on 11th of October. The orchard in pasture. The foliage on the sprayed trees showed a richer color than on the unsprayed, and the fruit quite free from scab.

SIMCOE—NORFOLK.

1st—May 1st—Clear and fine; windy. Buds just opening here, and at the request of Mr. Trinder and all the others, sprayed a few trees in the old orchard as well as the young orchard.

2nd—May 13th—Clear, cold and a high wind. Frost has done great damage here. The foliage on the hickory, walnut, oak and some other varieties are a dark brown color as if singed by fire; grapes, cherries and plums all gone.

3rd—May 28th—Clear, fine and warm; a slight frost this morning. Foliage here badly singed by the frost and fruit about a total loss.

4th—June 10th—Clear, fine and very warm. Foliage improving very much since the frost; you can see quite a difference in the foliage on the sprayed and unsprayed trees, but very little fruit left.

5th—June 21st—A slight shower in the forenoon, cleared up. Foliage looking well on most of the trees; some have not recovered from the frost.

6th—July 4th—Fine and warm, with high wind. No sign of spot on the leaf on sprayed trees, and very little on the unsprayed.

Inspected the orchard of Mr. Trinder, Simcoe, County Norfolk, on the 11th of October, and found very little to report. Foliage fairly good, but the frost had been too severe, followed by drouth, rendered impossible any result.

JARVIS—HALDIMAND.

1st—May 2nd—Clear, fine and warm. A young orchard about twenty years old, in sod, but not an old sod.

2nd—May 16th—Clear and fine. Messrs. Ionson and Miller did the spraying on the 16th; the day I was here, the 14th, it was snowing all day.

3rd—May 29th—Clear, warm, with quite a breeze. Foliage on some of the trees looking very well; on others not so slightly injured by frost; very few apples; some walnut trees that I was examining to-day look as if they were entirely killed.

4th—June 11th—Clear, warm, and quite a wind. Foliage improving on most of the trees, a few showing the effects of the frost; the spot showing on the unsprayed trees; none on the sprayed trees.

5th—June 22nd—Clear, warm, and quite a breeze. Foliage looking very well.

6th—July 5th—Clear, fine and high wind. Foliage looking very fair, some of the leaves beginning to curl, caused by the drouth; very dry here.

Inspected Mr. Ionson's orchard, Jarvis, County of Haldimand, October 12th; found the foliage somewhat better on the sprayed than on the unsprayed trees, the fruit more perfect in form and color, and of larger size on the sprayed trees. The frost and drouth has been too severe to expect any very favorable results.

MARSHVILLE—MONCK.

1st—May 3rd—Warm, but a shower an hour after spraying. This orchard is cultivated and well pruned.

2nd—May 15th—Clear, but cold wind. Buds looking quite fresh, a good show of bloom.

3rd—May 30th—Clear, fine and warm. This orchard does not appear to be so badly damaged by frost the Baldwins, Russets and Spys are showing a fine crop.

4th—June 12th—Clear and warm, a slight shower, 9 p.m. Foliage looking very fresh and fine, very little sign of spot on leaf or fruit.

5th—June 24th—A shower in the morning, cleared up, and then sprayed. A fine show of apples here, no sign of spot on fruit or foliage and very little on the unsprayed trees.

6th—July 6th—Clear, fine, and a high wind. Foliage here looking very fine and of good color: fruit fine and most of the trees well loaded.

Inspected the orchard of Mr. J. W. Overholt near Marshville in the County of Monck on the 8th of October; the foliage fairly good and the crop of apples very heavy, of good color, almost entirely free from scab and damage by the codling moth; the fruit of medium size caused by the abundant crop and the drouth. Mr. Overholt said he was convinced from the first spraying that there was business in it. He purchased the pump and sprayed the whole orchard, and is more than pleased with the results. The apples in an adjoining orchard and same kind of soil were more scabby and a larger number stung with the codling moth.

WELLAND—WELLAND.

1st—May 4th—Clear and very warm. About half of the orchard cultivated, the trees were pruned and the trunks scraped clean.

2nd—May 16th—Clear and cold. Another slight frost this morning, apparently little damage done except to early varieties; grapes destroyed.

3rd—May 31st—Clear and warm. The foliage in this orchard fairly good. Baldwins, Russets and some other varieties from one-third to one-half destroyed by frost.

4th—June 13th—Clear in the morning, rain in the afternoon. Mr. Reuter sprayed the trees again on the 17th inst., the weather clear and fine but windy.

5th—June 25th—Clear, fine and warm. Foliage good, very little sign of spot on the sprayed or unsprayed trees.

6th—July 8th—Rain all day. Mr. Reuter will make the application when the weather fines up. Fruit and foliage looking fairly good.

Inspected Mr. Reuter's orchard near Welland on the 8th of October and found the foliage good; some three or four trees of the "Seek no Further" not so good; Baldwin and Rhode Island Greenings were fine in foliage, the fruit of even size and good color, free from scab and damage by the codling moth, much more so than on the unsprayed trees.

THEDFORD—LAMBTON.

1st—April 26th—Windy. Got the work well done considering the high wind.

2nd—May 8th—Very warm. Foliage pretty well advanced, fruit buds beginning to open.

3rd—May 21st—Fine and some wind. The tops of the trees appear to be injured by the frost; fruit prospects very light.

4th—June 3rd—Fine and warm. Foliage good, no signs of scab.

5th—June 14th—Fine. Foliage fair, no signs of scab on fruit or leaf; fruit prospects very light.

6th—June 26th—Fine. No change.

Inspected the orchard of Mr. John Davidson, Thedford, County of Lambton. The foliage on the sprayed trees was much more luxuriant than on the unsprayed. The crop was light on account of the frost, yet the fruit was entirely free from the scab, and would grade largely No. 1. Mr. John Davidson reports to me as follows, date Nov. 16th: "I have picked my apples and took particular notice of the percentage of first-class, and as near as I can judge there were seven-eighths of them free from any blemish."

CLINTON—HURON.

1st—April 27th—Fine, but windy. Condition of the orchard good.

2nd—May 9th—Fine. Condition of the foliage and fruit buds fair.

3rd—May 22nd—Fine, but windy. The foliage appears injured by the frost.

4th—June 4th—Rain and wind. The weather was unfavorable for the work on the 4th, and Mr. Weir made the aplication on the 6th when the weather was fine; foliage fair, no sign of scab.

5th—June 15th—Fine. Found several nests of caterpillars on trees that had not been sprayed.

6th—June 27th—Rain in the morning, but cleared up fine. Foliage good; quite a few apples stung with the codling moth on the unsprayed trees, but none on the sprayed trees.

Inspected the orchard of Mr. Weir near Clinton in the County of Huron. His orchard is in a good state of cultivation and well manured with farmyard manure. I could not say I saw any marked difference in the sprayed and unsprayed trees, and only here and there an apple could be found. The foliage was still well covered with the Bordeaux.

WALKERTON—BRUCE.

1st—April 29th—Fine. Orchard in sod, trees about 30 to 35 years old.

2nd—May 10th—Clear and very warm. Foliage fairly good.

3rd—May 23rd—Fine but windy. Foliage withered looking and very little show of fruit.

4th—June 5th—Fine and very windy. Quite a heavy shower one hour after the spraying; foliage badly injured by the frost.

5th—June 17th—Fine. Foliage not very good; very dry here.

6th—June 28rd—Rained in the morning, but cleared up fine again. Some wormy apples on the unsprayed trees, but none on the sprayed; very little fruit here.

Inspected Mr. David Smith's orchard, Walkerton, on the 18th of September. The foliage on the sprayed trees showed a richer color than on the unsprayed, although not very marked. The frost had evidently been quite severe in this locality, and the long continued drouth immediately following had very much lessened the vitality of the trees. Here and there only could an apple be found; they were quite free from scab and insect. The orchards in the vicinity showed the same unfavorable appearance.

MOUNT FOREST—WEST WELLINGTON.

1st—April 30th—Fine. Orchard in sod.

2nd—May 11th—Rain soon after the spraying. Foliage fair; fruit buds beginning to open.

3rd—May 25th—Fine, but rained during the night. Foliage fair, but the prospects for fruit not very abundant.

4th—June 6th—Cold and drizzling rain. Foliage fair; no sign of spot on the fruit or foliage.

5th—June 18th—Fine. No change apparent.

6th—June 29th—Fine. Foliage good; no sign of the scab on fruit or foliage; Mr. Stewart sprayed his whole orchard; one row left.

Inspected Mr. David Stewart's orchard, Mount Forest, County of Wellington, on the 19th September. The foliage on the sprayed, although showing signs of the frost, were of a rich green color—more so than on the unsprayed. The frost here occurred while many varieties were in full bloom; the Spy being a little later escaped almost uninjured. Result, a fairly good crop of this variety; the sample quite free from scab, of fair size and good color. Some Baldwins also of good size and color, quite free from scab. The unsprayed row was not nearly so good. This orchard will show quite plainly the advantage to be gained by a thorough application of the Bordeaux mixture.

OWEN SOUND—GREY.

1st—May 1st—Fine. The orchard in fair condition as to cultivavation and pruning; a large number of people out to witness the work.

2nd—May 13th—Fair and cold. The foliage not quite so much advanced as the other points.

3rd—May 27th—Dull and looking like rain. Foliage good, and prospects of fruit very fair.

4th—June 7th—Fair. Foliage good; no sign of scab on fruit or foliage; orchard in fine shape.

5th—June 19th.

6th—July 2nd—Fair. Foliage good; no sign of scab on fruit or foliage; quite a few stung with the codling moth on the unsprayed trees.

Inspected the orchard of Mr. John Kilborne, Owen Sound, September 20th. The foliage in very good condition, and fairly so on the unsprayed trees. The fruit quite free from the scab and also the effects of the codling moth. Here were conditions quite favorable for fungi—soil quite rich, and the orchard sheltered, being in a valley. On the unsprayed trees we found some affected with the scab, and quite a few stung by the codling moth.

MEAFORD—NORTH GREY.

1st—May 2nd—Fine. Orchard in good cultivation.

2nd—May 14th—Cold and snowing all day. Foliage backward.

3rd—May 28th—Fine. Foliage good; fair prospects for fruit.

4th—June 8th—Fine. Foliage good; no sign of spot on leaf or fruit.

5th—June 20th—Fine. Foliage good; no sign of spot on leaf or fruit.

6th—July 3rd—Fine. Foliage fine.

Inspected Mr. Plunkett's orchard September 20th, and found the trees in a very healthy condition throughout. He had sprayed all his orchard. He had a fine crop throughout, free from scab and damage by the codling moth. Some varieties such as the Snow, that are very susceptible, were entirely free.

Mr. Plunkett's statement of percentages: Spys, seven trees, about three per cent. stung, and seven per cent. small and unfit for market, owing to the crowded state of the trees; Russets, four trees, ten per cent. stung, all a poor sample, trees overcrowded; Baldwins, one tree, about three per cent. stung, all good sample throughout; Seeks, three trees, good sample, none stung; three Greenings, good sample, none stung; one Alexander, good sample, two per cent. stung; one Wagener, good sample, three per cent. stung. Mr. Plunkett says: I would remark here, my Russets on all my other trees were a poor sample and appeared to be only half grown, while the Baldwins were very large and good. I cannot here draw a comparison between the twenty trees sprayed by your man and the rest of the orchard, as I sprayed five times. I do remember, however, some ten years ago, before spraying was practised, the codling moth had the big half.

Collingwood—East Grey.

1st—May 3rd—Fine but windy. Orchard in good state of cultivation and well pruned.

2nd—May 15th—Cold. Buds, I fear, nipped by the frost.

3rd—May 29th—Fine and very warm. Caught pretty bad with the frost; prospects for fruit light.

4th—June 10th—Fine. Foliage good; no sign of spot on leaf or fruit; very dry here.

5th—June 21st—Fine. Foliage good.

6th—July 4th—Fine but windy. Foliage good; no scab; orchard looking fine; can see quite a difference in the foliage and also in the fruit on the sprayed trees.

Inspected Mr. William Marshall's orchard near Collingwood on the 20th of September. His trees are in a fine healthy condition, and producing a fine crop of clean fruit, free from scab and codling moth. Colverts, Ribstons, St. Lawrence and Greenings beautiful in form and color, showing good results of the spraying, and also of manuring and cultivation for several years.

Barrie—West Simcoe.

1st—May 4th—Fine and warm. Orchard in sod but well pruned.

2nd—May 16th—Windy and cold. Foliage fair; buds somewhat discolored by the frost.

3rd—May 30th—Fine and very warm. Foliage good; prospects for fruit fair.

4th—June 11th—Fine but windy. Foliage good; no sign of scab on fruit or leaf; fruit looking splendid.

5th—June 22nd—Heavy shower about seven hours after spraying. Good fair show of fruit.

6th—July 6th—Fair but windy. Foliage good; no scab; the sprayed trees look better than the unsprayed.

Inspected Mr. Lloyd's orchard Sept. 21st, Barrie, county of West Simcoe. Foliage in a fine healthy condition, quite free from brown spot; the fruit of medium size on account of the extreme drouth, but very good in color and entirely free from scab and the codling moth. The fruit was somewhat damaged by a local hail-storm. The Tetofsky and Duchess, Mr. Lloyd informs me, were a very good crop and free from scab and codling moth. They had been marketed. The unsprayed trees in the orchard showed a paler leaf and the scab to some extent.

Orillia—East Simcoe.

1st—May 6th—Fine. Cultivation very good.

2nd—May 17th—Fine. Foliage fair.

3rd—May 31st—Fine and warm. Foliage very good and fruit prospects fair.

4th—June 12th—Fine. Foliage good; no sign of scab on fruit or leaf.

5th—June 24th—Fine. Foliage fine; no signs of fungus.

6th—July 6th—Fine. Foliage splendid; far ahead of the unsprayed trees.

Inspected the orchard of Mr. Wellington Fisher, near Orillia, in the county of East Simcoe. Found the sprayed trees looking exceedingly fine in foliage and the fruit quite free of the apple scab and of good size and color, in fact some beautiful specimens. Here I found good cultivation and pruning, and a fine growth of wood.

NEWMARKET—YORK.

1st—May 7th—Showery. Fairly pruned, sod well manured.

2nd—May 18th—Fine, but rained two hours after spraying. Foliage fair.

3rd—June 1st—Fine and very warm. Foliage fair, fruit prospects not very good.

4th—June 13th—Fine. Foliage fair, no appearance of the scab.

5th—June 25th—Fine. Foliage fair, no appearance of the scab.

6th—July 8th—Fine. Foliage good, no sign of scab on the sprayed trees; they look much greener in color than on the unsprayed.

Inspected the orchard of Mr. Silas Armitage, near Newmarket, in the county of York, on the 15th of October. The foliage on the sprayed trees was of a better color than on the unsprayed trees. There was little difference in the fruit; less fungi perhaps on the sprayed trees. The fruit had all been picked and put in the barn at the time of my visit.

WHITBY—ONTARIO.

1st—April 29th—Fine. Orchard two years in sod. Pump did not work freely.

2nd—May 10th—Fine. Foliage good, fruit buds just opening.

3rd—May 25th—Fine. Foliage good, fair show of fruit, the pump had been overhauled and works good.

4th—June 6th—Fine. Foliage good, fair crop.

5th—June 18th—Fine. Foliage good.

6th—July 2nd—Windy. Foliage good, fruit free from scab.

Inspected Mr. Howden's orchard, Whitby, county of Ontario, on the 5th of October. The foliage in this orchard is very good and the fruit quite clean and of good size. If there is any difference to be noted here, the fruit on the sprayed trees are less injured by the codling moth.

BOWMANVILLE—WEST DURHAM.

1st—April 30th—Windy. Orchard two years in sod.

2nd—May 11th—Rain in the forenoon again after spraying. Foliage good, not many fruit buds.

3rd—May 27th—Cold and windy. Foliage good, promise of about one-quarter of a crop.

4th—June 7th—Fine. Foliage good.

5th—June 19th—Fine. Foliage good.

6th—July 3rd—Fine. Fruit clear of scab.

Inspected Mr. Joseph Jeffrey's orchard, near Bowmanville, on the 5th of October, the whole of the orchard had been sprayed, the foliage fairly good throughout, but not of a rich color, the orchard in meadow would account for this. Of the experimental trees, some two of the Yellow Belle-fleur trees had a moderate crop, the fruit clean and bright. Mr. Jeffrey said they had been badly affected with fungi for a number of years. He had sprayed some Flemish Beauty pears with good results.

COBOURG—WEST NORTHUMBERLAND.

1st—May 1st—Windy. Orchard in good cultivation.

2nd—May 14th—Windy. Fruit buds just beginning to open.

3rd—May 28th—Windy, Foliage good and prospects of fruit good.

4th—June 8th—Fine. Foliage good.

5th—June 20th—Fine. Foliage good and a fine show for fruit.

6th—July 4th—Fine. Foliage good; crop good and clean from the apple scab.

Inspected the orchard of Mr. W. H. Morton, near Cobourg, in the county of Northumberland, on the 4th of October. I found the orchard in good state of cultiva-

tion and the foliage very good ; a beautiful crop of fruit. Mr. Morton was not at home, but I copy the following from a statement he sent me under date November 4th. He says : " I am late about writing you about the spraying. I give you Mr. Wilson's views (the buyer). He says : 'They are much larger, freer from spots and worms.' I have seen one lot of twenty-two barrels, and there was only one barrel of culls ; there was twice or three times that many on the trees not sprayed."

BELLEVILLE—WEST HASTINGS.

1st—May 2nd—Fine. Orchard in meadow for seven years.
2nd—May 14th—Windy, rain three hours after spraying. Foliage good ; nearly in bloom.
3rd—May 29th—Fine. Foliage good ; bloom all off.
4th—June 10th—Fine. Foliage good ; about half crop of fruit.
5th—June 21st—Fine. Foliage good ; half crop clean and free from spot.
6th—July 5th—Fine. Foliage good ; half crop, clean and free from spot.

Inspected the orchard of Mr. John Aris, near Belleville, in the county of Hastings. The foliage good but not rich in color ; the orchard has been too long in meadow, and the dry season greatly lessens the vitality of the trees ; the fruit on the sprayed trees was very free from the apple scab and almost entirely free from damage by the codling moth, while the unsprayed trees were more or less affected and the fruit of smaller size.

NAPANEE—LENNOX.

1st—May 3rd—Fine. Orchard in good state of cultivation and well pruned.
2nd—May 15th—Rain in the morning. Foliage good ; nearly in bloom.
3rd—May 30th—Fine. Foliage fair.
4th—June 11th—Windy. Foliage fair.
5th—June 22nd—Fine. Foliage good.
6th—Work not done.

Inspected the orchard of Mr. C. W. Hambly, near Napanee, on the 3rd of October. Foliage good ; the American Golden Russetts entirely free from scab ; some Ben Davis were also sprayed ; they also showed good foliage and a beautiful crop of clean, high colored specimens.

CATARAQUI—FRONTENAC.

1st—May 4th—Rain in the morning. Fine. Orchard in sod.
2nd—May 16th—Fine. Foliage not good.
3rd—May 31st—Fine. Foliage does not show a healthy appearance ; crop prospects light.
4th—June 12th—Windy. Foliage not very good.
5th—June 24th—Windy. Foliage not very good.
6th—July 8th—Fine. Foliage improved in appearance and promise of half a crop.

Inspected the orchard of Mr. Lancaster, Cataraqui, near Kingston, on the 3rd of October. Foliage very good ; much better than on the unsprayed trees. The Russetts and Spys almost entirely free from scab and of good size and color ; one row of the La Rue had been picked and blown off by a high wind. Mr. Lancaster stated the fruit was very clean and fine, and the foliage was very fine indeed.

GANANOQUE—SOUTH LEEDS.

1st—May 6th—Fine. Orchard in sod.
2nd—May 17th—Fine. Foliage good ; some trees are showing bloom, others not.
3rd—June 1st—Fine. Foliage good ; crop prospects fair.
4th—June 13th—Windy. Foliage good ; crop prospects fair.
5th—June 25th—Windy. Foliage good ; crop prospects fair.
6th—July 9th—Windy. Foliage good ; scab showing on the unsprayed trees.

Inspected the orchard of Mr. J. M. Cornett, Gananoque, and found the foliage and also the fruit much better on the sprayed than on the unsprayed trees. The American

Golden Russetts and Ben Davis were almost entirely free from scab and the fruit of good size and color; the soil I should say in this orchard was very shallow and the rock near the surface; some of the unsprayed trees showed the effects of the drouth; the unsprayed Ben Davis were quite scabby and the Russetts also, and small in size, and many were worthless; at this point we experienced some difficulty; the first spraying was done with a small hand pump on account of the non-arrival by freight of the one intended, and for the third spraying Mr. Cornett was requested to apply the solution. Mr. Konkle, the experimenter, was called home on account of his sister's death.

BROCKVILLE—BROCKVILLE.

1st—May 7th—Pump did not arrive and none could be found for the occasion.

2nd—May 18th—Windy. Foliage not very good; some bud moths here, and some trees quite in bloom; orchard in pasture.

3rd—June 3rd—Rain in the morning. Foliage fair, prospects one-third crop.

4th—June 14th—Windy. Foliage fair, prospects one-third crop.

5th—June 25th—Windy. Foliage good; half crop; fruit clear of scab.

6th—July 10th—Windy. Foliage good; half crop; fruit clear of scab.

Inspected the orchard of Judge McDonald, in the town of Brockville, on the 2nd of October, found the foliage on the sprayed trees of richer color than on the unsprayed, the fruit quite free from scab or blemish by the Codling moth. The orchard is an old one, yet the foliage showed vigor in the trees. The Judge informed me they bore quite a heavy crop last year.

MORRISBURG—DUNDAS.

1st—May 8th—Rain in the morning; then fine. Orchard in sod.

2nd—May 20th—Windy and cold. Bud moth doing some damage; some trees quite in bloom.

3rd—June 4th—Fine. Foliage good; promise of a fair crop.

4th—June 15th—Fine. Foliage good.

5th—June 27th—Rain after spraying. Foliage good and fruit free from spot.

6th—July 11th—Fine. Foliage good and fruit clean and free from scab.

Inspected the orchard of Mr. Henry Smith, near Morrisburg in the County of Dundas. Mackintosh Red, Duchess and Russetts were sprayed; the foliage exceedingly good, much better than on the unsprayed trees, the fruit also of larger size; of good color and free from blemish. The Duchess had been picked and marketed, but Mr. Smith informs me the crop was good, of clean smooth sample, all the Duchesses were sprayed, none left for comparison.

CORNWALL—CORNWALL.

1st—May 9th—Windy. Orchard in sod.

2nd—May 21st—Fair. Foliage good; in bloom.

3rd—June 5th—Rain in the morning; sprayed at 10 a.m.; rain again at 2 p.m. Foliage good; crop prospects good.

4th—June 17th—Fine. Foliage good; crop prospects good.

5th—June 28th—Fine. Foliage good; crop prospects good.

6th—July 12th—Windy. Foliage good; crop good and clean of scab.

Inspected the orchard of Mr. Blacklock, East Front, Cornwall, and found very satisfactory results, the foliage on the sprayed trees was much darker in color than on the unsprayed, the fruit of good size and fine color. Mr. Blacklock informs me the St. Lawrence were exceedingly fine, they had been marketed, but the Fameuse were still on the trees, of fine size and color and scarcely a spot to be seen on those sprayed, while the unsprayed, although not as bad as in former years, some were scabby. The fruit on the sprayed trees were almost entirely free from the Codling moth.

Only a few years ago the idea as suggested by our scientists of spraying our orchards with the different solutions for the prevention and destruction of fungous diseases and insect enemies was considered by many as only a theory, and one not of practical application in a large orchard, but we find our manufacturers to the front with appliances whereby the work can be done speedily and thoroughly. We have to-day the strongest proof of the benefits of spraying. If you will carefully trace the results in my detailed report, you will see in nearly every point a marked improvement in the condition of the foliage. The health and vigor of the tree must be maintained if profitable results are to be expected. In making this report I have endeavoured to under-estimate rather than to magnify the results obtained, for the simple reason that we are liable sometimes to allow our prejudice as regards new methods to outweigh the real condition, and more particularly so in a season like the one just past, when this query is so often brought forward: "Why was my orchard that has never been sprayed so free from the fungus and insect enemies?" Few orchards have of late years been free in this respect. This theory may apply. The rapid development of fungus and insects caused by the extreme warm weather in early spring, followed by an unusually low temperature causing their destruction while in a tender stage of development, and this followed by a prolonged drouth perhaps not favourable to second growth. In some sections covered by the work where the temperature was very low the trees did not entirely recover from the shock, and in some other cases where orchards have been in sod and hay gathered, perhaps for years, we can scarcely expect a healthy foliage; but where good cultivation and pruning has been practiced we find the best results follow.

If there is one matter to-day in connection with fruit culture that should engage our most undivided attention, it is, in my opinion, the cultivation, pruning and spraying of our orchards, for in this, in nine cases out of ten—in production—the whole secret of success or failure depends, as sure as the night follows the day. Eternal vigilance is the price of good fruit and should be inscribed in letters of gold, as the motto, in the mind of every fruit grower in our land.

I have received many enquiries during the past season in regard to spray pumps, and those enquiries might be summed up in these words, "Which pump do you consider the best and the most desirable?" I will take this opportunity to reply, we have used during the past season five different makes, namely: The Aylmer, manufactured by The Aylmer Iron Works; The Parker Excelsior, manufactured in London, Ont.; The Ontario Wind Engine & Pump Co., Toronto; The Clarksburg Pump, manufactured by Holmes & Halliday, Clarksburg, and The Goold, Shapley and Muir Co., Brantford, the Ideal, and they all gave good satisfaction. Improvements are being continually made as practical experience shows is required. One of great importance, the "Mechanical Agitator," will cause better results to follow by the more even distribution of the fungicides and insecticides. The nozzle is another improvement. The Boss nozzle, that is still quite useful for washing buggies and windows, has given place to others of superior construction and that will produce the finest spray, or one of greater volume, as may be desired. As to durability, I am not sufficiently acquainted with the chemical action of copper sulphate upon the different materials used in the manufacture of spray pumps, but I am inclined to think that brass or brass lining would lessen the corrosive action better than iron. Much loss might be avoided by thoroughly rinsing out the pump with clear water before putting away after use.

I cannot close this report without expressing my unbounded confidence in the benefits that will accrue to the fruit grower who will most thoroughly apply the different fungicides and insecticides as recommended by our horticulturists and chemists, who are working along that line. Failures, I think, may be attributed to several causes; not applying at the proper time to check the spread, imperfectly prepared mixtures, too much guess work as to quantities, and last, but by no means least, *thorough agitation* during the whole application. If each ingredient is required to make the mixture perfect, it must be evenly and equally distributed to obtain the desired result. As the bud worm is becoming quite numerous in some sections, I would suggest, that instead of using copper

sulphate and water in the first spraying, the lime and Paris green be added. The same result would be obtained, and the lime would assist to fasten, as it were, the Paris green upon the bud and destroy the bud moth, perhaps, before it had destroyed the bud.

Some pointers along the line that often cause delays and hinder the work: Some little part of the pump not being inspected as carefully as it ought to have been before putting it together, and the fruit grower, not being an exper in that line, cannot discover the remedy until his patience has been severely taxed. Another, but more common occurrence is that after the tank has been filled and ready for business, it is allowed to stand, if only for a few minutes, the lime and Paris green quickly settle to the bottom; then the first few strokes of the pump causes quantities of this to be sucked up from the bottom, the pump and nozzle become clogged, and the manufacturer sometimes comes in for a share of the blame. Remedy: shut off the stop cock and thoroughly agitate the solution before you commence to spray; do not drench the tree but spray it, rinse the pump out thoroughly before putting away after using it, and don't buy a spray pump on account of its cheapness, but look for efficiency and durability. Time is money, and we can ill afford to loose much of it at the season of spraying our trees.

I have the honor to be, Sir,

Your obedient servant,

A. H. PETTIT.

APPENDIX B.

SPRAY PUMPS.

An exhibition of spray pumps was held at Grimsby on April 2nd, 1896, under the auspices of the Board of Control of the Fruit Experiment Stations. The preliminary arrangements were made by Mr. A. H. Pettit and Mr. L. Woolverton. Eight Canadian and three American pumps were exhibited.

The following information was prepared by Mr. H. L. Hutt, Horticulturist at the Ontario Agricultural College, Guelph, and Mr. Murray Pettit, Winona, President of the Ontario Fruit Growers' Association and manager of the Wentworth Fruit Experiment Station :

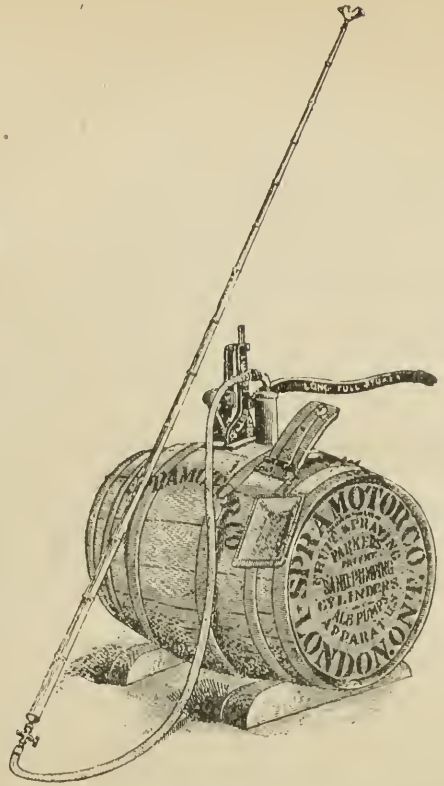
Considering that the manufacture of spraying outfits is a comparatively new industry, it must be acknowledged that great credit is due to the manufacturers for the effort they have made to meet fully the requirements of this new demand.

The appliances first used were more or less unsatisfactory, because makers were not aware of all that was needed to make a spraying outfit effective, handy, and durable. The improvement already made along this line has been rapid, and one of the greatest immediate results of this trial, we believe, will be the still further improvement of many of the pumps now offered for sale.

Makers who never before enjoyed the pleasure of spraying a row of large trees, in a cold, blustering wind, were brought face to face with some of the difficulties which fruit growers have to encounter, and could not but see wherein their outfits might be improved, and in what respects other makers were ahead of them. Those who experienced a wrestling match, trying to hold on the wagon a tall pump mounted on top of a barrel, while the horses plunged in the mud, and low-hanging limbs swept over them, could not but see that it was a decided advantage to have the pump low and compact, and mounted on the side of a barrel with a firm foundation. Others who were doused with Bordeaux mixture, splashing out of unnecessarily large openings in the barrel, could not but be impressed with the advisability of close fitting covers to all such openings. Those who had to shake their barrels to stir the rapidly settling Bordeaux mixture, and who found, even then, that the first few trees received nearly all of the lime and copper-sulphate, while those at the other end of the row received water only, had ocular proof that their agitators were not all they had thought them to be. Those who when they came to spray trees thirty feet in height, had to hunt up poles to elevate their nozzles and heavy hose to the required height, will no doubt be quick to adopt some such convenience as the bamboo or gas pipe extension rod. The desirability, too, of easily operated stop-cocks on each extension rod was apparent to all who had to clean out choked nozzles or travel far from one tree to to another.

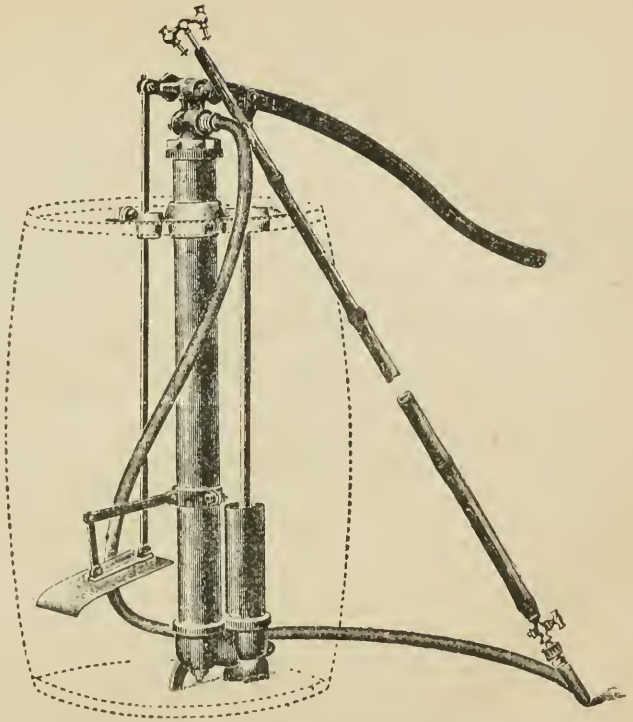
Description of Pumps.

The following illustrations and descriptions of pumps as exhibited, together with prices of the same, will be of interest to fruit growers :



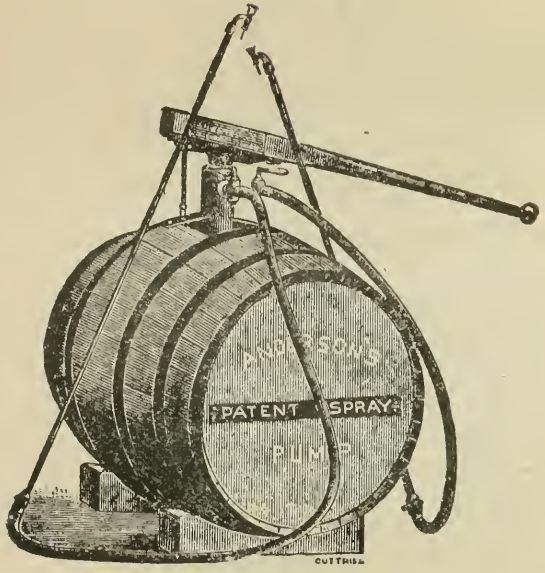
Spramotor No. 2 E.

Made by the Spramotor Co., London, Ont. Price without barrel, $18.60. Pump mounted on side of barrel, working parts brass, dash agitator on suction pipe, one lead of hose, bamboo extension rod, three Spramoter nozzles.



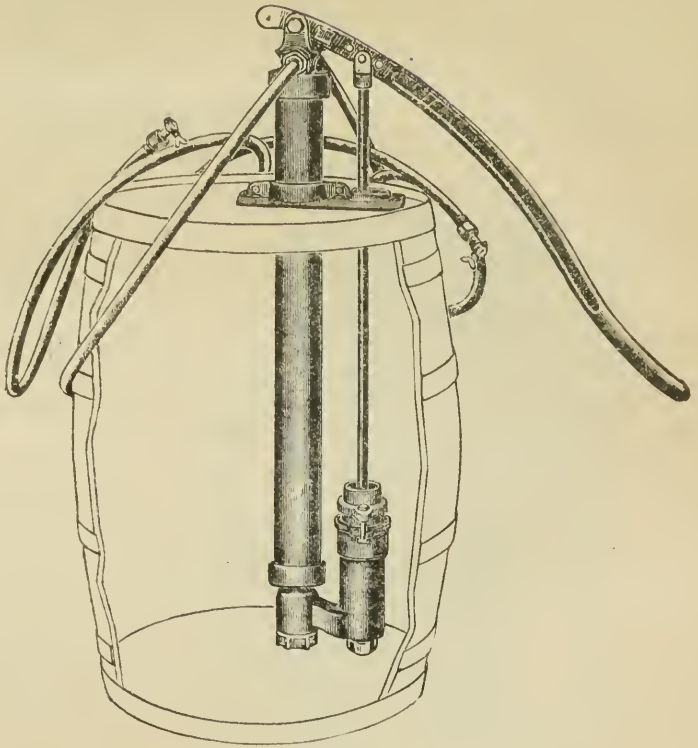
Eclipse No. 3.

Made by Morrill & Morley, Benton Harbor, Mich., U.S. Price without barrel, $24. Pump mounted on end of barrel, all brass, Eclipse automatic agitator, one lead of hose, bamboo extension rod, double Vermorel nozzles.



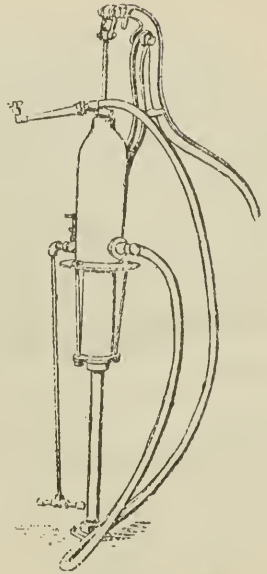
The Anderson Spray Pump.

Made by the Aylmer Iron Works, Aylmer, Out. Price without barrel, $15.50. Pump mounted on side of barrel, all working parts brass, dash agitator attached to movable lower cylinder, two leads of hose, gas pipe extension rods, three Vermorel nozzles.



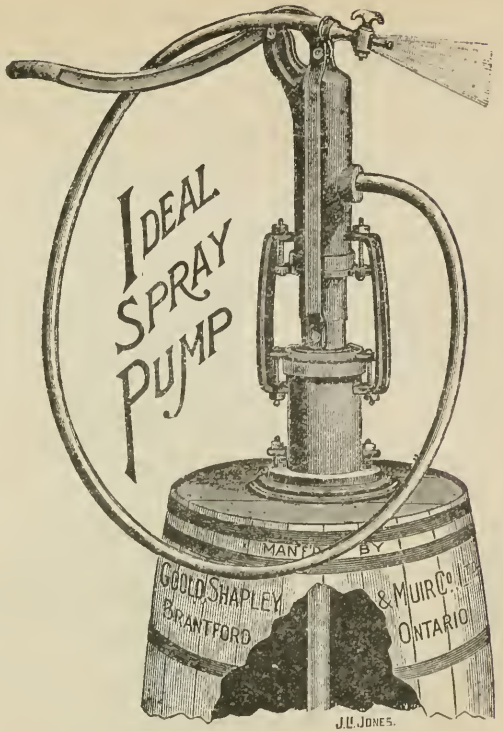
Pomona.

Made by The Goulds Manufacturing Co., Seneca Falls, N.Y. Price without barrel, $15. Pump mounted on end of barrel, brass working parts, paddle agitator, one lead of hose, gas pipe extension rod, three Vermorel nozzles.



The Clarksburg Pump.

Made by Holmes & Holladay, Clarksburg, Ont. Price without barrel, $13. Pump mounted on end of barrel, brass working parts, double dash agitator, two leads of hose, brass extension rod, two Clarksburg nozzles.



Ideal Spray Pump.

Made by Goold, Shapley & Muir Co., Brantford, Ont. Pump mounted on end of barrel, brass working parts, two leads of hose, McGowan and Vermorel nozzles.

No. 1 "*Ideal*" *Iron Pump* with 7 feet ¾ inch rubber hose, galvanized pipe for depth of ordinary barrel, with strainer attached, and one Vermorel or McGowan nozzle, $9.00.

No. 2 "*Ideal*" *Iron Pump* with three-way brass stop-cock, two lengths of ¾ inch rubber hose and two nozzles, Vermorel or McGowan, selected, and galvanized pipe and strainer for barrel, $11.00.

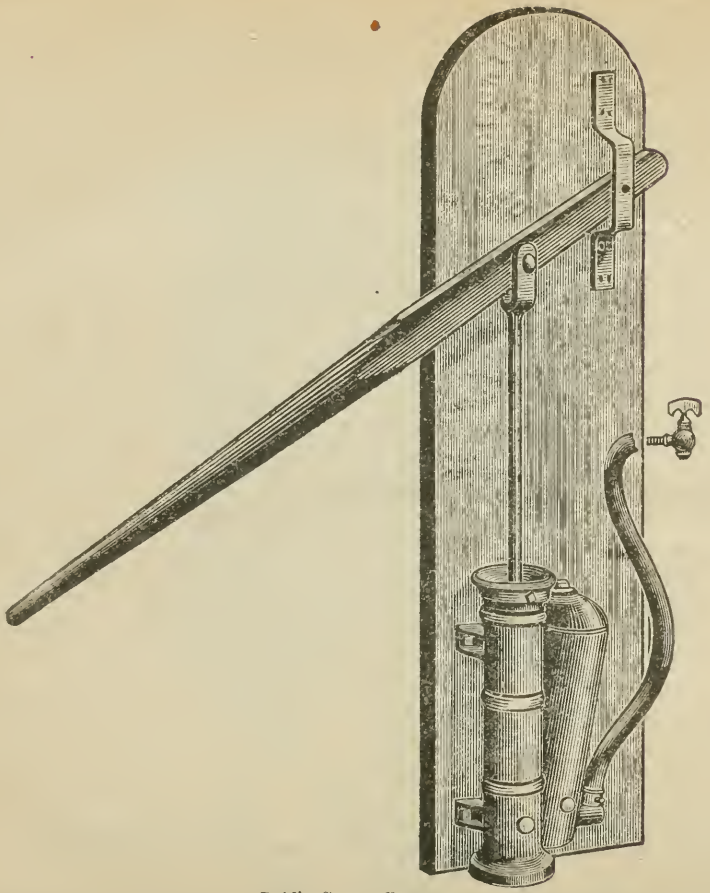
Brass Plunger, for either pump, extra, $1.00. *Dash Agitator*, complete, extra, 75c.

The Gem.

Made by The Ontario Wind Engine and Pump Co., Toronto, Ont. Price without barrel, $16.50. Pump mounted on end of barrel, working parts brass, churn dash agitator, two leads of hose, McGowan and Vermorel nozzles.

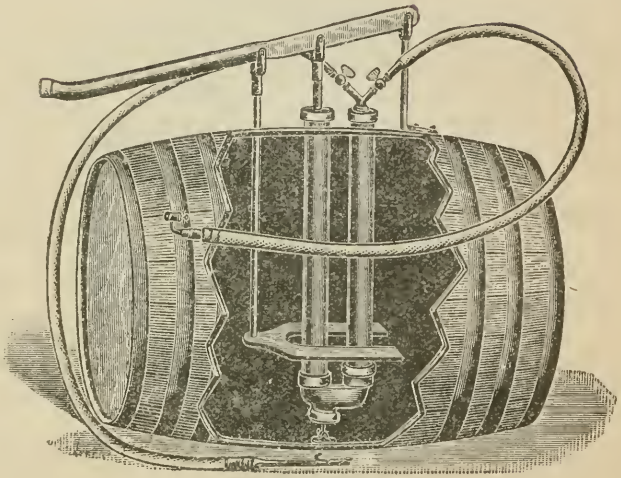
The Empire King.

Made by Field Force Pump Co., Lockport, N.Y. Price, $14. Pump mounted on end of barrel, brass working parts, geared revolving agitator, one lead of hose, two Niagara nozzles.



Reid's Spray Pump

Made by Thomas Reid, Hamilton, Ont. Price without barrel, $5. Pump set in barrel on end, iron and wood, agitator a discharge at bottom of cylinder, two leads of hose, one gas pipe extension rod, one Vermorel and one Masson nozzle.



The Defender.

Made by P. C. Lewis Manufacturing Co., Catskill, N.Y. Price, with barrel, ready for use, $11.50. Pumps mounted on side of barrel, all brass, wooden dash agitator, two leads of hose, two Vermorel nozzles.

The Wilson Sprayer.

Made by the Rotary Spray Pump Co., London, Ont. Price complete, $8. A garden pump consisting of a barrel attached to a wheelbarrow. Wooden rollers working over the hose cause suction, tin disc nozzle.

Suggestions as to the Best Kinds of Pumps.

The following suggestions will be of great importance to manufacturers, and should be of much use to fruit growers in selecting pumps for their use :

1. Pump should be furnished fitted to barrel, ready for use. The majority of fruit growers have not the facilities for mounting a pump properly.

2. Pump should be made as low as possible and mounted on the side of a barrel, fixed to blocks for support. This would prevent many an upset.

3. All openings in the barrel should be furnished with tight-fitting, convenient covers, both to prevent liquid from splashing out and to keep dirt out of the barrel.

4. Agitators should be made to agitate thoroughly the contents of a barrel full of liquid. Something on the dash principle is found to be the most effective. It is an advantage if the agitator can be worked independently of the pump, so as to agitate the liquid thoroughly before commencing to spray.

5. Each pump should be equipped so that one or two leads of hose may be used as desired. For overhead work, each lead should be at least twelve or fifteen feet long and made of good, four-ply, half-inch hose.

6. For use among large trees, each pump should be supplied with a light extension rod six or eight feet in length, of bamboo, brass or gas pipe.

7. The base of each extension rod should be furnished with a stop-cock which can be worked by hand. This is not only useful when cleaning the nozzles, but effects a saving of liquid when passing from one tree to another.

8. Only those nozzles which throw a very fine spray should be used. The improved double Vermorel nozzle, when used with a good extension rod, has not yet been surpassed even for large trees.

9. All metal parts of an outfit coming in contact with the mixture should be made of brass, in order that they may withstand the corrosive influence of copper sulphate.

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